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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Investment Performance of Canadian Mutual Funds, 1971-1980 submitted by Alyce Campbell in partial fulfilment of the requirements for the degree of Master of Business Administration.

Abstract

In this study the investment performances of 103 Canadian mutual funds in the period 1971-1980 were measured and analyzed for two purposes:

1. to make it simpler for interested individuals to evaluate mutual funds as an investment alternative;
2. to find out whether or not actual mutual fund behaviours were in accord with currently accepted financial theory—notably the efficient markets hypothesis.

Measures used to assess the performance of one fund relative to another were the Sharpe Index and the Treynor Index. The performances of the funds were also compared to the performance of the market proxy, the Toronto Stock Exchange Composite 300 Index with dividends(the TSE 300 Index), using the Jensen Index, the transformed Sharpe Index, and the transformed Treynor Index.

In the second part of the analysis, the relationships between performance and other mutual fund characteristics were examined. The characteristics considered were: whether or not a fund charged a sales fee; total assets; rate of net new deposits; whether a fund qualified as a registered retirement savings plan(RRSP); management expense ratio; fund objectives; and fund manager.

This information was also used to study investor behaviour. The relationships between rate of net new deposits in 1976-1980 and fund characteristics and

performance in 1971-1975 were investigated to determine which of the characteristics, if any, were used by investors in their decision-making.

The conclusions are:

1. The performance measures used indicate that in the study period mutual funds performed statistically no differently than the TSE 300 Index.
2. When the relative performances of the funds in 1971-1975 were compared to their relative performances in 1976-1980, the rankings were unrelated or negatively related.
3. The volatility of the funds was lower in 1976-1980 than in the 1971-1975, with 55 percent of the funds significantly less volatile. This is in keeping with the increase over the decade in the proportion of fixed-interest securities held by the the funds. The estimated β's of 11 funds which held portfolios composed primarily of fixed-interest securities were found to be significantly negative in the second five years, which seems to be attributable to a change in the relationship between the stock and bond markets.
4. The returns series have the autocorrelation structures of series based on time-ordered price movements. This is consistent with the conclusion of other researchers that many stocks on the Toronto Stock Exchange were moderately to infrequently traded in the study period.
5. The best estimate of β for a number of funds was

obtained using a model incorporating both lagged and led market terms, as well as the synchronous market term. This suggests that the average frequency of trading of securities held by these funds differed from the average frequency of trading of stocks in the TSE 300 Index.

6. Performance was not linearly related to the size of a fund, the rate of net new deposits, or the management expense ratio. In 1971-1975, income funds as a group outperformed other funds and in 1976-1980 significantly underperformed other funds. Funds with RRSP status marginally outperformed non-RRSP funds in the first five years. In 1976-1980, funds charging a load fee outperformed funds which did not.

7. Rate of net new deposits in 1976-1980 was linearly related to performance in 1971-1975, suggesting that investors were behaving as expected according to the efficient markets hypothesis. However, rate of net new deposits was also significantly positively related to percent management fee in 1971-1975 and to the fact that funds charged a sales fee. This is contrary to what would be expected if investors are using only risk-adjusted returns in their decision-making.

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I. INTRODUCTION: PURPOSE AND SCOPE OF THIS PROJECT

This thesis describes the results of a study of the observed return behaviour of 103 Canadian mutual funds over the interval 1971-1980. The aim of this project was to measure and analyze the investment performance of these funds [1] in order:

1. to make it easier for private investors to evaluate mutual funds as an investment alternative, by providing information on past mutual fund behaviours;
2. to determine whether, overall, the observed behaviours are congruent with or contradictory to current financial theories, notably the efficient markets hypothesis.

An individual's assessment of whether or not an investment is satisfactory depends on the number, kind, and value of the assets he holds and his particular assessment of the riskiness of that investment. To reduce this subjectivity, it is desirable to use an index that rates performance relative to some standard that is acceptable to investors as a group. Such an index should also have been shown to have some value when applied to the observed behaviours of similar investments, and be easy to measure. In addition estimates of the index should be relatively free

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[1] Also of interest to economists is the industry's performance in channeling capital to the most profitable economic opportunities. A study of this aspect of performance would require detailed information on portfolio composition and rates of change in these portfolios. As such information is not readily available, this aspect of industry performance was not investigated.

from measurement error, regardless of the time of measurement or the size of sample measured.

Economic theory provides a variety of measures that can be used to study mutual fund performance but each is dependent on specific assumptions about managerial and market behaviour for its validity. That is, each is looking at performance from a narrow perspective, depending on what behaviours the researcher concluded would lead to superior performance. Since the process of managerial and market decision-making is not directly observable and the systems are dynamic, there is no reason to assume that a given set of assumptions will always apply. Thus there is little assurance that a single measuring device will adequately differentiate one fund from another or describe the industry's performance overall. More reliable estimates of the performance of a fund relative to other funds or to a standard portfolio are obtained using several measures that together provide information on the extent to which the funds are successful in attaining the economic objectives of those who choose this method of investing.

The first two measures used to compare one investment alternative to another are the mean return and total variability of return (the "riskiness" of the investment [2])

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[2] How to measure risk is a subject of much debate. The financial model adopted in this study assumes that investors as a group assess risk according to the total variability in return, or the variance of the expected return distribution. This is adequate if the return distributions are approximately normally distributed and symmetric.

so these were the first measures estimated. For those investors holding more than one asset, volatility in return (or response to changes in the general economic conditions) is the more relevant measure of risk, since this is the portion of risk that cannot be avoided through diversification [3]. This is the asset's "β" value. It is estimated by computing the ratio of the covariability between the fund's returns and the returns on a market index to the total variability in market index returns, and this value was estimated for all funds as well. Taken separately these are not good indicators of performance because there should be differences in return: investors that accept higher risk should be compensated with higher expected returns. Useful performance measures will allow comparison of the risk-adjusted returns of the funds. To accomplish this two ranking measures are used: the Sharpe Index which measures return relative to total risk, and the Treynor Index which measures return relative to volatility(the systematic risk).

Individuals wishing to invest in securities may find mutual fund shares an attractive option because the funds are large poolings of assets managed by professionals, two features which might be assumed to result in risk-adjusted yields higher than those attainable from self-managed portfolios of much smaller total value. Certainly, simply

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[3]Evans, J. and Archer, S.H. (1968): Diversification and reduction of dispersion: an empirical analysis; *Journal of Finance*, Vol. 23, pp. 761-767.

due to their size, most funds are able to buy and sell securities in large blocks, which reduces transactions costs substantially, and to hold a wide range of securities which reduces risk. However, such a reduction in risk could be achieved through random purchase of a sufficient number of stocks. Maintaining a diversified portfolio is usually classed as a form of passive management of the portfolio. The manager chooses a target risk level and tries to find the set of securities that together form a portfolio of the appropriate risk, then periodically adjusts the composition of the portfolio as his asset base and market conditions change. Thus it is germane to estimate how diversified mutual fund portfolios were and to determine, if possible, whether these levels of diversification were maintained over time.

Being diversified is not sufficient, however. Maximum benefit from diversification is achieved only if the portfolio is efficient [4]. When capital markets are in equilibrium, all efficient portfolios are a combination of the market portfolio(the set of all assets which are expected to return future income) and a risk-free asset. Since it is not possible to buy a percentage of all assets

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[4] An efficient portfolio of a given variance (risk) yields returns higher than any other portfolio of the same risk; that is, all other portfolios that yield the same return will be more risky, when risk is measured by the total variability in returns. The theory of efficient opportunity sets was first defined by Markowitz in:
Markowitz,H. (1959): *Portfolio Selection: Efficient Diversification of Investments*; John Wiley and Sons Inc., New York, 200 pages.

(for example, few of us distribute shares based on the expected return from our own education), managers must try to select an optimal portfolio from the subset of assets that are financial instruments. Finding such a portfolio is a complex task, since the manager must not only choose which securities are suitable but must also determine how much of each security to include, as both the fund's β and the effectiveness of diversification are a function of the relative market values of each individual security within the portfolio. If the manager is successful in finding and maintaining such a portfolio, the performance of his fund will be no different from that of the proxy for the market portfolio that is relevant to his situation. Although most investors could not afford to "buy the market" many funds could attempt to hold such a portfolio which is *ex ante* the efficient portfolio with zero dollars invested in a risk-free asset.

Many investors would also like to believe that professional managers are able, through their expertise, to earn better than average risk-adjusted yields, either by successfully selecting "underpriced" securities or by successfully predicting general market movements, and adjusting the portfolios accordingly. If one found empirical evidence demonstrating that indeed some managers had consistently earned abnormal returns (that is, had "outperformed the market") when applying these active management strategies, it would contradict a widely accepted

economic theory, the efficient markets hypothesis. This hypothesis [5] states that at any time the prices of assets in the market "fully reflect" all relevant information. That is, all new relevant information is quickly and, on average, correctly incorporated into the market's estimate of the expected return on an asset. Consequently, on average, expectations of returns will be realized, and the expected value of the gain from new information is zero. Empirical evidence on United States capital markets supports this hypothesis if "relevant information" is defined to mean all publicly available information on the stock market, company annual reports, and statistical data on the economy [6]. If Canadian capital markets are also efficient, then fund managers who have access only to information available to the rest of the market should not be able to outperform the market and earn abnormal returns [7]. Thus the performance of the market index is an appealing benchmark for both practical and academic reasons.

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[5]Fama has discussed the concept of efficiency in capital markets at length. For example see Fama, E.F. (1970): Efficient capital markets: a review of theory and empirical work; *Journal of Finance*, Vol. 25, pp. 383-417.

[6] A comprehensive review of the empirical evidence is provided in Tiniç S.M. and West, R.R.(1979): *Investing in Securities: An Efficient Markets Approach*; Addison-Wesley Publishing Company, pp. 489-520.

[7] However, if the fund manager, through his position, can obtain inside information he may be able to earn windfall profits on certain stocks, since this information may not necessarily be impounded into asset prices. It is also important to note that by chance some managers will do better than the market, whether or not they have any predictive abilities. Such transient superior performance is not inconsistent with the hypothesis.

In this study the market portfolio proxy used is the Toronto Stock Exchange Composite 300 Index with dividends, and the performances of the funds were compared to this index using three different measures. These are the transformed Sharpe Index, the transformed Treynor Index, and the Jensen Index.

Because different investors have different needs and risk-preferences, mutual funds differ in their overall riskiness. This raises the question: does performance relative to the market proxy differ according to riskiness of the fund? Another widely accepted economic theory, the capital asset pricing model, states that prices are determined only by the volatility of the investment and the return on the market portfolio. If true, the relationship between risk and return is linear, so that although returns increase with risk, performance should be independent of risk, if the performance measures properly account for risk. Two related issues are whether or not the observed riskiness matched the the fund's stated investment objectives and whether or not performance is related to these objectives. A fund's stated objectives presumably guide the manager in his choice of target risk level and also help the investor decide whether the fund is an appropriate investment, so it is useful to know how well declared intentions corresponded to actual behaviours.

Although there are 103 funds in the sample, only 39 different management groups are represented. Nineteen of

these groups managed more than one fund. Since no group should have consistently outperformed the market whether they managed one or many funds if Canadian capital markets are efficient, it is of interest to consider the overall performance of each managing group. This was accomplished by evaluating the performance of a group's "portfolio of portfolios" as though it were an individual fund.

Even if no management group consistently outperformed the market, this does not preclude the possibility that one manager may have consistently outperformed other management groups. All things being equal, a second consequence of the efficient markets hypothesis and capital market theory is that the "best" investment strategy is to find and maintain a well-diversified portfolio. Thus, those managing groups who consistently tried to time the market or devoted much resources to searching for underpriced or overpriced securities may, on average, have performed more poorly than those who adopted a more passive managerial approach, due to higher costs incurred in information-gathering and transacting. Although the management group's decision-making model cannot be readily identified, consistently poor decisions will reveal themselves in the performance measures.

An individual investor may take into account fund characteristics other than previous performance and fund manager when predicting the expected return on a particular fund. Some of these factors, such as the age and size of the

fund, may influence an individual's assessment the fund's riskiness. Other factors, such as the fund's policy on reinvesting or distributing dividends may alter his expectations of returns on the fund. It is thus of practical concern to establish whether or not risk or performance was consistently related to any of these factors. The fund characteristics that were studied in this project are whether or not a fund qualified as a registered retirement savings plan(its RRSP status), whether or not a fund charged a sales fee, fund size, rate of net new deposits, and management expense ratio [8].

In efficient capital markets which provide a wide range of investment opportunities, no persistent systematic relationships between these factors and performance are expected. Short-term effects could be observed, however. For example, returns could be inversely related to percent management fee if a group of funds consistently spent too much on information-gathering or made too many transactions. However, returns information is publicly available, so over the long term, investors would shift capital from poorer performers to better performers, and competition would force

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[8] This in certainly not an exhaustive list of such factors, but information on other factors such as policy on reinvesting dividends, amount of sales charges, portfolio composition, and average turnover rate is either difficult to obtain or difficult to quantify or both. For an individual investor additional concerns are his own unique tax situation, the nature of his portfolio, his investment horizon, and his attitude towards risk. These investor-specific factors are not included in this study because of the paucity of information on the people who choose mutual funds as an investment vehicle.

managers to change investment strategy. In less-developed markets, where the number and range of investment opportunities are restricted, mobility of capital may not be unconstrained. If, for example, there were an optimal size of fund given the general state of Canadian capital markets, overly small or overly large funds could do worse than funds of the appropriate size. This would mean that performance could also be systematically related to rate of new deposits, since rate of growth would influence total asset base available. There is no reason to expect any relationship between load charge or RRSP status, and fund performance regardless of the state of the market, unless for some reason rate of net new deposits were tied to one of these variables. If investors started systematically to choose no-load funds, for example, (which might be rational if previously no-load and load funds had performed no differently) the load funds would decline in size which might influence performance. Similarly a significant change in tax laws affecting the regulations governing RRSP's could alter the relative rates of growth of RRSP and non-RRSP funds sufficiently to bring the size factor, if it exists, to bear.

This information was also used to test whether investors actually behave as predicted by the efficient markets hypothesis, by examining the relationship between rate of net new deposits in 1976-1980 and performance in 1971-1975. Rate of net new deposits in the second five years

should be related to previous performance of the fund and inversely related to load charge and management fees if investors were informed and acting rationally there was no systematic relationship between performance and load charge or management expense ratio in the first five years. That is, since load charges and higher fees reduce the expected returns to the investor, all things being equal, investors should have chosen funds that were no-load and had relatively low management fees [9].

This dissertation is organized as follows:

1. Chapter II is a short description of the characteristics of mutual funds.
2. Chapter III is a discussion of the performance measures, and the methods used to estimate them.
3. The findings of earlier, similar studies of the Canadian and the United States mutual fund industries are briefly reviewed in Chapter IV.
4. Chapter V describes the database constructed for this study and the methodologies used in the the empirical analysis.

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[9] Admittedly, this is a somewhat simplistic analysis, since other considerations enter into an investor's final choice. Three major factors not considered or measured are the nature of purchase and redemption plans, the actual value of sales charges, and the impact of taxation. However, the effect of these factors is very investor-specific, and no information is readily available on those people who have chosen mutual funds as a form of investing. Information of interest would be income level, occupation, age, purpose for investing, investment horizon, and nature of asset holdings. Such information could be obtained using a survey technique. This was clearly beyond the scope of this investigation.

5. The results are presented and discussed in Chapter VI.
6. In the concluding chapter, Chapter VII, the overall findings are summarized.

II. MUTUAL FUNDS AS FINANCIAL INVESTMENTS

A. CHARACTERISTICS OF MUTUAL FUNDS

Open-end investment companies [10] have two unique characteristics which distinguish them from other types of corporations. A mutual fund may sell shares to interested investors at any time, so that its capitalization changes over time. Also owners of mutual fund shares have the right to redeem their shares on demand at a price determined by the current liquidation value of the assets in the mutual fund (minus redemption charges, if any).

Mutual fund shares are not sold through stock exchanges, but rather are distributed by the funds directly or are sold through registered brokers. A purchaser pays an offering price which is the sum of the *net asset value per share* (navps) plus a sales charge [11], if any. Net asset value per share is defined as the total assets at current market value minus total liabilities divided by number of shares outstanding. Most funds calculate their navps daily and are required by law in Canadian jurisdictions to

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[10] This discussion of the features of mutual funds is based on the material found in: The Canadian Securities Institute (1980): *Canadian Mutual Funds*, 96 pages.

[11] The sales charge is used to compensate the sellers of the fund's shares for their selling expenses and efforts. The amount charged differs from fund to fund, and is usually quoted as a stated percent of total value of shares purchased. Most funds have a regressive scale for this charge with percent declining with value of purchase. Most funds collect this fee when the shares are purchased, but some collect it in installments and others deduct the charge when the shares are redeemed. A "no-load" fund is one that does not collect the a sales charge.

calculate this value at least once per month. The redemption price is the most recently calculated navps minus any redemption fee and sales charge, if any.

The potential economic benefits of investing in mutual funds were noted earlier (the reduction in transactions costs from economies of scale; the level of diversification attainable; and the alleged skill of professional managers, the subject of this dissertation). However, mutual funds also provide a number of financial services which also contribute to their appeal as an investment. Most funds offer a variety of purchase and redemption plans, including accumulation plans and annuities, which provides flexibility for the investor. The right of redemption allows an individual to convert his investment to cash relatively quickly, should the need arise, and often more quickly than other investments of similar potential return (such as real estate or art work) open to holders who have limited amounts of excess cash to invest.

Most funds target their marketing efforts on investors who are seeking a relatively safe longer-term method of accumulating capital in the securities markets. These funds typically choose the components of their portfolios from the whole range of securities available, within the limits imposed by law or by their charters. Thus they stress the benefits of diversification and of superior managerial ability. However, a number of funds do specialize in investments of a single type or in a specific geographical

region, or in a single industry. For example, the Royal Trust "M" fund specializes in mortgages, and the Goldfund invests at least 50 percent of its assets in gold bullion or in securities of companies directly involved in the world gold-mining industry. In some cases, this specialization makes the fund very speculative, and can increase rather than decrease the investor's risk, despite the broad asset base.

Mutual funds are an important segment of Canadian financial institutions as shown by the total assets held during the interval of study. The relevant figures [12] (in current dollars) are given in Table 1, along with data about the composition of the fund portfolios. However, in this interval, redemptions exceeded sales in every year except 1980 for funds belonging to the Canadian Mutual Funds Association [13], but the annual personal savings rate in Canada rose from about 5.5 percent in 1971 to 10.5 percent in 1980 [14] so the popularity of mutual funds as an investment ebbed during this period. Note that in 1971 bonds and other assets (mostly bank deposits, mortgages and short-term notes) constituted roughly 11 percent of assets held. In 1980 these assets formed about 40 percent of mutual fund portfolios.

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[12] Bank of Canada(1982): *Bank of Canada Review*; January.
[13] The Canadian Securities Institute(1980): *Canadian Mutual Funds*; p. 70.
[14] Jarrett,J.(1980): Why Canadians save more than Americans; *The Canadian Business Review*; Autumn, pp. 37-40.

Table 1. Holdings of Canadian mutual funds

(in millions of Canadian dollars)

a	b	c	d	e	f	g	h	j
0,023	0,017	0,066	1,431	0,966	0,058	0,126	2,688	1970
0,017	0,020	0,068	1,564	1,138	0,014	0,288	3,109	1971
0,012	0,024	0,091	1,776	1,068	0,015	0,383	3,369	1972
0,008	0,025	0,118	1,576	0,601	0,010	0,544	2,882	1973
0,016	0,028	0,119	1,135	0,357	0,027	0,606	2,287	1974
0,022	0,044	0,149	1,254	0,500	0,014	0,703	2,686	1975
0,051	0,050	0,140	1,204	0,533	0,028	0,799	2,784	1976
0,067	0,050	0,161	1,129	0,431	0,030	1,182	3,050	1977
0,084	0,064	0,179	1,178	0,558	0,037	1,652	3,752	1978
0,143	0,051	0,180	1,371	0,738	0,071	1,733	4,287	1979
0,254	0,072	0,157	1,758	1,134	0,094	1,616	5,087	1980

a: Government of Canada bonds
b: Bonds and notes of other levels of government
c: Corporate bonds
d: Canadian equity issues
e: foreign equity issues
f: other foreign assets
g: other assets, mostly mortgages, short-term notes and cash
h: TOTAL
j: year

SOURCE: Bank of Canada(1982): *Bank of Canada Review*, January.

B. RESTRICTIONS ON PORTFOLIO COMPOSITIONS

Although presumably fund managers strive to obtain as high risk-adjusted yields as possible on their portfolios, in order to attract new investors, certain restrictions may force them to choose portfolios that are not optimal according to economic theory. Some significant constraints

imposed by regulatory bodies [15] that influence investment decisions are:

1. funds may not borrow for leverage purposes, nor may they short-sell securities;
2. no more than 10 percent of the assets of a fund may be held in the securities of a single issuer;
3. no more than 10 percent of the assets of a fund may be committed to options; and no more than 5 percent may be committed to warrants;
4. mortgages and bonds may be held in unlimited amounts provided that the fund holds liquid assets in amounts sufficient to meet the minimum level specified in the National Policy statements of Canadian securities commissions;
5. funds may not purchase commodities or unauthorized stock.

In addition to being constrained by laws and securities regulations, many fund managers are constrained by articles in the fund's charter or trust instrument. Examples are

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[15] This discussion is based on the Ontario Securities Act of 1980. Securities regulation is a provincial responsibility in Canada, so laws may be slightly different in other provinces. The authority to administer securities acts is usually delegated to a provincial securities commission. These commissions have from time to time issued National Policy statements governing the activities of mutual funds, which in effect have the force of law. Over the interval of study a number of statutes were revised and policy statements modified. No attempt is made here to describe these changes other than to note that most of these changes were directed at standardizing selling methods, improving the information content of quarterly and annual reports, and increasing the investor's protection against poor or fraudulent management practices.

restrictions on percent of foreign assets held, and restrictions on proportions of different security types held.

For large funds in particular, these constraints are magnified by the limitations of the Canadian capital markets. Firstly there are relatively few really large Canadian corporations in some industries, which reduces the possibilities for diversification. For example, as of December 31, 1980, textile manufacturers accounted for 0.25 percent out of 100 percent in the Toronto Stock Exchange Composite Index and no plastics manufacturing firm was among the largest 300 companies. Thus a fund manager may not be able to purchase stocks from all industries or may not be able to purchase the quantity of stock of a single issuer that financial analysis indicates optimal. Also, there are comparatively few institutions(dealers and brokers) willing and able to engage in large block trades, so the fund manager may not be able to purchase or sell large blocks of shares at the most beneficial time (especially if other institutions want to make the same type of transaction with the same stocks), or may have to resort to buying or selling shares in a number of smaller transactions, increasing the costs, to attain the desired portfolio composition. Thus, for both of these reasons, smaller funds may have a comparative advantage in that the managers of these funds may find a wider choice of investment opportunities available to them.

Offsetting this potential advantage is the potential for larger funds to benefit from economies of scale. It may be "cheaper" relatively to manage a larger fund if, for example, the larger fund can reduce transactions costs by buying or selling securities in larger blocks. Also if the cost per unit of information gathered is the same for small and large funds, the larger fund will need to spend proportionally less. Thus, smaller funds face constraints too, in the information market and through the fact that transactions are carried out by agents who charge variable fees.

The limitations of Canadian capital markets are illustrated in relevant statistics from the Toronto Stock Exchange [16] which are presented in Table 2, especially when these statistics are compared to similar statistics for the New York Stock Exchange, reputed to be the most well-developed stock market in the world and the reference market for many studies of United States funds. For example in 1978 figures for the New York Stock Exchange [17] were:

1. number of companies—1581;
2. total quoted market value—$1288 billion, of which $828 billion was equity issues;
3. total shares outstanding—26.8 billion;
4. percent of total trading in blocks of over 10,000

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[16] Toronto Stock Exchange(1980): *Toronto Stock Exchange Review*, December and Toronto Stock Exchange(1981): *Toronto Stock Exchange Review*, January.
[17] New York Stock Exchange(1979): *1979 Fact Book*; 78 pages.

Table 2. Statistics on the Toronto Stock Exchange

a	b	c	d	e	f	g	h	i
905	227.1	56.9	8.0	4.6	24.0	22.5	44.4	1976
885	234.0	62.3	8.2	4.6	25.6	24.3	45.5	1977
821	256.0	79.4	8.1	4.8	29.1	29.1	43.8	1978
799	325.6	112.6	9.3	5.3	29.7	30.9	41.6	1979
799	444.7	139.4	11.5	6.6	27.6	31.1	37.5	1980

a: number of companies listed
b: total quoted market value ($billions)
c: total quoted market value-Canadian based companies ($billions)
d: total shares outstanding (billions)
e: total shares outstanding-Canadian based companies (billions)
f: percent of total trading on all Canadian exchanges in orders of $100,000 and over
g: percent of total trading on TSE in orders of $100,000 and over
h: percent of TSE member equity business from all institutions, including banks, insurance companies, pension funds, mutual funds, and non-profit organizations; mutual funds accounted for 2.17 percent in 1979 and 1.76 percent in 1980
i: year

SOURCE: Toronto Stock Exchange(1980): *Toronto Stock Exchange Review*, December.
Toronto Stock Exchange(1981): *Toronto Stock Exchange Review*, January.
Toronto Stock Exchange(1981): *Fact Book, 1981*.

shares— 22.9 percent.

A final, very important constraint is the need to maintain sufficient reserves of cash to meet predicted rates of redemption. The manager may feel the need to hold more short-term paper and bank deposits than he would like given his judgement of what constitutes a properly diversified portfolio for his target β. If his estimate of rate of

redemption is incorrect, it could prove costly, due to lost returns or to having to sell securities at a reduced price in order to obtain needed cash to meet shareholder demand.

III. MEASURING PERFORMANCE

For reasons noted in the first chapter, no single measure is used in this study to evaluate mutual fund performance. Rather, a set of measures is used to examine investment performance from several perspectives, since both investors and funds differ widely in their economic goals and behaviours. The aspects that are of interest are:

1. the stability of a fund's riskiness over time and the relationship between risk and stated objectives;
2. the ability of a fund's manager to minimize risk through diversification, within the constraints imposed by law, charter of incorporation, and market conditions;
3. the ability of a fund's manager to buy undervalued and sell overvalued securities;
4. the ability of a fund's manager to predict general economic changes and adjust the portfolio accordingly;
5. the relationship, if any, between a fund's performance and characteristics of the fund unrelated to risk and yield.

Ideally the performance measures could be used not only to rank the funds, but also to indicate absolute differences in performance which could be tested for significance.

The measures of risk are the total variability in a fund's returns and the fund's β value. One measure of diversification, which is used in this investigation, is the amount of variability in fund returns explained by the

variability in market proxy returns. Two generally accepted indicators of relative performance are the Sharpe Index, and the Treynor Index. Three statistics used to compare absolutely the performance of a fund and the performance of the market proxy are the transformed Sharpe Index, the transformed Treynor Index, and the Jensen Index. Because all of the measures are derived from either capital market theory or the capital asset pricing model, these two theories are briefly summarized to help clarify the logic behind the measures [18].

Notation

Some of the discussions of the theory and the methodologies include variables which should be double subscipted for mathematical precision. However, to simplify the discussion, subscripts are only used if necessary for clearness. The symbols used in this study are defined in Table 3.

A. CAPITAL MARKET THEORY

According to capital market theory, if the market is in equilibrium, the expected return in a single holding period on an efficient portfolio is linearly related to total risk

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[18] This review is not intended to be a full explanation. More detailed descriptions are found in Copeland, T.E. and J.F. Weston(1979): *Financial Theory and Corporate Policy*; Addison-Wesley Publishing Company, 618 pages and Tiniç, S.M. and West, R.R.(1979): *Investing in Securities: An Efficient Markets Approach*; Addison-Wesley Publishing Company, 612 pages.

Table 3. Symbols used in this study

N: total number of funds in the sample, for $i=1,2,...,n,...N$;

T: total number of monthly observations, $t=1,2,..,t,..,T$; t not indicated unless needed for extra clarity;

$\bar{x}$: arithmetic average of observed returns on portfolio x; that is, the sample mean of observations;

$u(x)$: population mean of returns on portfolio x;

s(x): standard deviation of returns over time for portfolio x; sample standard deviation;

s(x): true standard deviation of returns for portfolio x; population standard deviation;

navps: observed net asset value per share at the *beginning* of month t, for fund i;

d: sum of dividends and capital gains paid by fund i in month t;

rt: observed return on fund i in month t;

r: observed excess return in continuously compounded form for fund i in month t;

mkt: return on the market portfolio in a single period t;

mp_0: observed monthly return on the market proxy in month t;

m_0: observed excess return on the market proxy in continuously compounded form in month t;

m_1: observed excess monthly return on the market proxy led one month;

m_{-1}: observed excess monthly return on the market proxy lagged by one month;

m_{-2}: observed excess monthly return on the market proxy lagged by two months

rft: return on a riskless asset in a single period t;

rf: observed return on proxy for a riskless asset in month t;

β: true systematic risk for fund i;

$\hat{b}$: estimated systematic risk for fund i;

JN: true Jensen measure for fund i;

jn: estimated Jensen measure for fund i;

SH: true Sharpe measure for fund i;

sh: estimated Sharpe measure for fund i;

shm: transformed Sharpe measure for comparing the performance of fund i to the performance of the market proxy;

zsh: standardized transformed Sharpe measure;

TR: true Treynor measure for fund i;

tr: Treynor measure as traditionally estimated for fund i;

trr: revised estimate of Treynor measure;

trm: transformed Treynor measure for comparing the performance of fund i to the performance of the market proxy;

ztr: standardized transformed Treynor measure;

$\hat{\rho}$: estimated autocorrelation for fund i.

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through the following relationship [19]:

$$E(\widetilde{rt})=rft+[E(\widetilde{mkt})-rft] \times [s(\widetilde{rt})/s(\widetilde{mkt})].$$

That is, the expected return on an efficient portfolio is equal to the return on a risk-free asset, plus the product of the return premium on the market and the ratio of standard deviation of the returns on the fund to the standard deviation of the returns on the market portfolio.

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[19] This relationship was first developed by J. Tobin and is presented in:
Tobin, J.(1958): Liquidity preference as behavior towards risk; *Review of Economic Studies*, Vol. 25, pp.65-86.

B. CAPITAL ASSET PRICING MODEL

The capital asset pricing model was independently introduced by Sharpe[20] and Lintner[21] and states that if the market is in equilibrium, the expected one period return on a risky security or portfolio of securities is equal to the return on a riskless asset plus the product of the security's systematic risk and the difference between the expected return on the market portfolio and the return on a risk-free asset [22], where systematic risk is that portion of an asset's total risk that is highly correlated to overall changes in economic activity. Algebraically:

$$E(\tilde{rt})=rft+\beta[E(\tilde{mkt})-rft].$$

where

$\beta=COV(\tilde{rt},\tilde{mkt})/VAR(\tilde{mkt})$, for all securities or portfolios $i=1,2,...,n$.

The characteristic line, and the systematic risk, for a

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[20] Sharpe, W.F.(1964): Capital asset prices: a theory of market equilibrium under conditions of risk; *Journal of Finance*, Vol. 19, pp. 425-442.

[21] Lintner, J.(1965): The valuation of risk assets and selection of risky investments in stock portfolios and capital budgets; *Review of Economics and Statistics*, Vol. 47, pp.13-37.

[22] Two assumptions that underlie the capital asset pricing model as described are that investors may borrow or lend any amount at a risk-free rate and that investors may short-sell as they wish.

Black proposed an alternative version of this model in which he postulated that when borrowing and lending at a risk-free rate is restricted but short-selling is allowed the expected return on any asset is a linear combination of the return on the market portfolio and the minimum variance, zero-beta portfolio. For a discussion of this model see Black, F.(1972): Capital market equilibrium with restricted borrowing; *Journal of Business*, Vol. 45, pp. 444-455
The Sharpe-Lintner version is the more widely accepted. The definition of asset volatility is the same in both models, however.

mutual fund i can be estimated with ordinary least squares regression techniques from time series data using the following risk premium version of the empirical model:

$$(rt-rf)=\alpha+\beta(mp_0-rf)+e.$$

The coefficient of determination of this regression is an estimate of the diversification of the portfolio relative to the market proxy, since it measures the amount of variability in portfolio returns explained by the variability in market proxy returns.

This model can be estimated using returns as observed or the returns can be converted to the continuously compounded form by taking the natural logarithm of one plus the return. This log-linear version is used for two reasons:

1. if returns are measured over periods longer than days the return distribution is better approximated by a lognormal distribution [23];
2. Merton [24] showed that, in equilibrium, the one-period capital asset pricing model can be extended to multiperiods if trading is continuous by substituting the continuously compounded rates of return for observed discrete rates of return.

Other models for the characteristic line

The time series regression model can produce reliable estimates of α and β only if the β of the fund remained

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[23] Copeland, T.E. and Weston, J.F.(1979): *Financial Theory and Corporate Policy*; Addison-Wesley Publishing Company, p. 175.
[24] Merton, R.(1973): An intertemporal capital asset pricing model; *Econometrica*, Vol. 41, pp. 867-888.

relatively constant over the historical period observed [25]. However, if a portfolio manager was successful in timing the movements of the market as a whole the β would have changed as the manager adjusted the portfolio composition [26] to compensate for changing conditions. In fact, when returns are bivariate normal, if the manager was completely successful, and was able to adjust the portfolio relatively quickly, the line would be concave upward, with the slope of the curve being greater with larger market premiums and smaller for small or negative market premiums. If the manager were systematically unsuccessful, the line would be convexly curved. If he had attempted this strategy by actively and frequently changing portfolio composition the true relationship could be best fit by any complex model in

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[25] Also, the estimates will only be unbiased and efficient if the assumptions underlying the ordinary least squares method are applicable to the particular returns series being studied. Briefly the method assumes that the error terms (the residuals) are independently and identically distributed with mean zero and a constant variance. The set of explanatory variables is assumed to be correctly specified with each explanatory variable having a singular distribution. The consequences of violating these assumptions are outlined in Wonnacott, R.J. and Wonnacott, T.H.(1979): *Econometrics*, Second Edition; John Wiley and Sons, Inc. New York, 580 pages.

[26] The β could also change if the manager adopted a "do-nothing" strategy, because the relative market values of the component securities (on which the portfolio β depends) would change with changing economic conditions. However Blume showed that while the β's of individual stocks tend to regress towards 1.00, the β's of portfolios tend to be stable in:
Blume, M.(1971): On the assessment of risk; *Journal of Finance*, Vol. 26, pp. 1-10.

between these two boundary lines. Treynor and Mazuy [27] used the following algebraic model to test for successful timing activity [28]:

$$(\tilde{rt}-rf)=\alpha+\beta(\tilde{mp}_0-rf)+\gamma(\tilde{mp}_0-rf)^2+\tilde{e}.$$

A statistically significant γ indicates that the characteristic line is a nonlinear function of the market premium.

When a portfolio's characteristic line is estimated from time series data using the capital asset pricing model, it is also assumed that the prices used in calculating the returns on the market proxy and on the portfolio reflect the market's most recent judgement of the value of the stocks from which these portfolios are composed. However, when securities are infrequently traded, prices may reflect noncurrent information. Fisher [29] discovered that the

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[27] Treynor, J. and Mazuy, K. (1966): Can funds outguess the market?; *Harvard Business Review*, Vol. 44, July-August, pp. 131-136.

[28] Kon and Jen discounted this method for checking for timing effects and suggested that the use of switching regressions would be more appropriate. A discussion of this is found in:
Kon, S.J. and Jen, F. (1978): Estimation of the time-varying systematic risk and performance for mutual fund portfolios: an application of switching regressions; *Journal of Finance*, Vol. 33, pp. 457-475.

Fabozzi and Francis used a two-regressions model to test for timing activities in:
Fabozzi, F.J. and Francis, J.C.(1979): Mutual fund systematic risk for bull and bear markets: an empirical examination; *Journal of Finance*, Vol. 34, pp. 1243-1250.

Recent work by G. Barone-Adesi(personal communication) indicates that the presence of a quadratic term in the characteristic line can be caused by co-skewness in the security's and the market proxy's returns.

[29] Fisher, L.(1966): Some new stock market indexes; *Journal of Business*, Vol. 39(supplement), pp.191-225.

explanatory power of the regression equation and the mean value of β estimated from value-weighted indexes tended to rise as the time between price measurements increased. His explanation for this was that the quoted values of any index or portfolio constructed from securities which do not all trade with the same frequency will be an average of the time-ordered values of the shares. Schwartz and Whitcomb [30] showed that the first-order autocorrelation of a series of returns from such an index will be positive, and that residuals from regressions of individual assets on such an index will be negatively autocorrelated. In a subsequent study these authors [31] found that for common stocks negatively autocorrelated residuals are typical for measurement intervals longer than 20 days. They noted that such behaviour would be observed for any series for which the measured value of the price and thus the return did not reflect the most current information, whether due to infrequency of trading, interference of market makers, or delayed response of investors in adjusting their portfolios. If such negative autocorrelations were observed for portfolios, such as mutual funds, they could even be due to the administrative procedures practiced by the fund, if the measurement interval were too short. Funds do not

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[30] Schwartz, R.A. and Whitcomb, D.K.(1977a): The time-variance relationship: evidence on autocorrelation in common stock returns; *Journal of Finance*, Vol. 32, pp.41-55.

[31] Schwartz, R.A. and Whitcomb, D.K.(1977b): Evidence on the presence and causes of serial correlation in market model residuals; *Journal of Finance and Quantitative Analysis*, Vol. 12, pp. 291-313.

necessarily recalculate navps daily or even weekly nor on the dates corresponding to dates when the market proxy is measured, if the interval is longer than daily. Thus, some non-synchroneity would not be surprising.

Dimson [32] used these results to demonstrate that β estimates from monthly data for individual securities are severely biased when frequency of trading is different from the average trading frequency of the components of the market index, and developed a model he termed the "aggregated coefficients" method for estimating β. The model states that the β can be estimated by taking the sum of the regression coefficients from the multiple regression of stock returns onto preceding, synchronous, and subsequent market returns. That is, algebraically:

$$(\widetilde{rt}-rf)=\alpha+\ldots+\gamma_1(\widetilde{mp}_{-1}-rf)+$$
$$\gamma_2(\widetilde{mp}_0-rf)+\gamma_3(\widetilde{mp}_1-rf)+\ldots+\widetilde{e}.$$

The number of lagged and led terms is determined arbitrarily, although an examination of the cross-sectional variances in the β's for each period can provide an indication of the number needed to eliminate the bias, since the lagged or led terms only contribute to the estimate of β as long as this cross-sectional variance is statistically different from zero.

If a share is traded less frequently than the market then lagged terms are of much more significance than led

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[32] Dimson, E.(1979): Risk measurement when shares are subject to infrequent trading; *Journal of Financial Economics*, Vol. 7, pp. 197-226.

terms and the reverse is true when the components of the market index are on average traded less frequently than the share. Thus it follows that if, on average, the components of a portfolio are traded less frequently than the components of the proxy, then for a regression of the portfolio returns on the proxy, lagged terms will be important. Conversely if the portfolio is traded on average more frequently the led terms will be important.

From the results of Schwartz and Whitcomb, this model can be generalized to be used for any set of returns which are expected to reflect nonsynchronous market movements, whether the cause is infrequent trading, slow reaction time of investors, or nonsynchronous measurements of the returns and the market proxy. For out-of-date prices, such as is possible for mutual funds (assuming no difference in average trading frequency in the fund and the proxy), only lagged terms would normally appear in the final estimate of the characteristic line.

C. PERFORMANCE MEASURES

The Jensen Index

If the capital asset pricing model is valid and markets are efficient, then the intercept term in the premium version of the fund's characteristic line should equal zero.

Jensen [33] reasoned, then, that this intercept term could be used as a method of assessing a manager's success in selecting securities, with values significantly greater than zero indicating superior performance and values significantly less than zero indicating inferior performance. The algebraic expression for this measure is:

$$JN=u(r)-\beta[u(m)].$$

Estimating the Jensen measure

The best estimate of the Jensen measure is obtained from the estimated linear characteristic line. That is:

$$jn=\hat{a}=\bar{r}-\hat{b}\bar{m}_0.$$

The null hypothesis

$$H_0:jn=0$$

can easily be tested using the t-statistic.

In calculating jn, it is assumed that the β of the portfolio was constant over the interval of observation. That is, it is assumed that the manager made no attempt to time the market. Grant [34] showed that if the manager is successful in his timing activities, the estimate of the Jensen measure will be downward biased.

There is also evidence that this measure is not completely risk-adjusted, but the empirical evidence on the amount and direction of this bias is conflicting. Black,

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[33] Jensen, M.(1968): The performance of mutual funds in the period 1945-1964; *Journal of Finance*, Vol. 23, pp. 389-416.
[34] Grant, D.(1977): Portfolio performance and the "cost" of timing decisions; *Journal of Finance*, Vol. 32, pp. 837-846.

Jensen and Scholes [35] showed that high β portfolios tend to have negative Jensen measures and low β portfolios positive values of this index. However, Klemkosky [36], McDonald [37], and Kon and Jen [38] all found that the Jensen Index was positively correlated with estimated β's using ordinary least squares regression techniques on data for United States funds.

The Treynor Index

The expression for the capital asset pricing model can be rearranged to :

$$[E(\widetilde{rt}-rft)/\beta]=[E(\widetilde{mkt}-rft)/\beta(\widetilde{mkt})].$$

That is, the expected risk premium on any fund per unit of systematic risk is equal to the expected risk premium on the market portfolio per unit of systematic risk on the market, where the market portfolio's systematic risk is defined to be 1.00, if the market is in equilibrium. Treynor [39] proposed, therefore, that the empirical version of the left-hand side of this expression be used as an index of

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[35] Black, F., Jensen, M.C., and Scholes, M.(1972): The capital asset pricing model: some empirical tests; in *Studies in the Theory of Capital Markets*, M.C. Jensen, editor; Praeger Publishers, New York, pp. 79-121.

[36] Klemkosky, R.C.(1973): The bias in composite performance measures; *Journal of Financial and Quantitative Analysis*, Vol. 8, pp. 504-514.

[37] McDonald, J.G.(1974): Objectives and performance of mutual funds; *Journal of Financial and Quantitative Analysis*, Vol. 9, pp. 311-333.

[38] Kon, S.J. and Jen, F.C.(1978): Estimation of time-varying systematic risk and performance for mutual funds: an application of switching regressions; *Journal of Finance* Vol. 33, pp. 457-476.

[39] Treynor,J.(1965): How to rate management of investment funds; *Harvard Business Review*, Vol. 43, January-February, pp. 63-75.

performance, with larger values indicating relatively superior performance and smaller values indicating relatively poor performance. In algebraic terms, the empirical version of this measure is:

$$TR = \mu(r)/\beta.$$

Estimating the Treynor measure

The traditional estimator of the Treynor measure is:

$$tr = \bar{r}/\hat{b}.$$

However, Jobson and Korkie [40] showed that the traditional estimator is biased, and that an unbiased estimator(approximately) is:

$$tr = (\bar{r}/\hat{b}) \text{ X } \{1/(1+(1/T)[(1/CORR(r,m)^2)-1])\}$$

The estimator for the variance of this parameter was shown to be:

$$VAR(tr) = (1/T) \text{ X } \{[s(r)]^2 + \bar{m}_0[1-(1/CORR(r,m_0))]\} \text{ X } \{[s(m_0)]^4/[COV(r,m_0)^2]\}.$$

Furthermore these authors provided a statistic for testing the hypothesis:

$$H_0: TR - TR(\text{market proxy}) = 0$$

which is estimated by:

$$trm = \bar{r} - \hat{b}\bar{m}_0$$ [41].

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[40] Jobson, J.D. and Korkie, B.M. (1981): Performance hypothesis testing with the Sharpe and Treynor measures, *Journal of Finance*, Vol. 36, pp. 889-908.

[41] That this is equivalent to the Jensen measure is fortuitous. Jobson and Korkie indicated that they tried several transformations to find the best statistic for comparing any two portfolios and concluded that the transformation:

$$tr(p_1,p_2) = [\hat{b}(p_1) \text{ X } \bar{r}(p_2)] - [\hat{b}(p_2) \text{ X } \bar{r}(p_1)]$$

was the most successful.

This can be standardized by dividing trm by the estimated standard deviation of the distribution to yield a statistic which is approximately normally distributed for number of sample observations greater than 60. This statistic is referred to as ztr in this report. For the purposes of this study, the expressions presented by Jobson and Korkie were modified by substituting $\hat{b}$ for $COV(r,m_0)/VAR(m_0)$ [42].

There is some evidence that the Treynor measure is correlated with its risk proxy. Such a correlation was noted by Klemkosky [43]. The revised estimator may not exhibit this undesirable property; no information is currently available.

The Sharpe Index

Sharpe[44] developed his measure from capital market theory which relates expected return on a well-diversified portfolio to its total risk. If, on average, expectations

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[42] It is important to note that in deriving the expected value and variance of the Treynor measure(and thus the statistic for the unbiased estimator) and in developing ztr, Jobson and Korkie estimated β using the expression $COV(r,m_0)/VAR(m_0)$. However, if the β estimate were from a model incorporating lagged and led terms, intuitively, the expressions for the best estimators the variances of the Treynor measure and ztr would include terms involving the covariances between each of the market proxy series and the return series and also the means of each of the series. Both expressions would be very complex. However, no one has analyzed the problem theoretically so these expressions cannot be specified. The original statistic proposed was not very powerful, and the modified version used in this investigation may be even less powerful. However, this is the only statistic available for comparing two Treynor measures.

[43] Klemkosky, R.C.(1973): The bias in composite performance measures; *Journal of Financial and Quantitative Analysis*; Vol. 8, pp. 504-514.

[44] Sharpe, W.F.(1966): Mutual fund performance; *Journal of Business* Vol. 39, pp. 119-138.

are realized, as implied by the efficient markets hypothesis, then *ex post*, the following relationship should be observed:

$$u(r)/s(r)=u(m)/s(m).$$

Sharpe concluded that a reasonable measure of performance would be the left-hand portion of this equation:

$$SH=u(r)/s(r).$$

Superior performance would be indicated by values significantly greater than the Sharpe measure of the market proxy, and inferior performance by values significantly smaller.

Estimating the Sharpe measure

The traditionally used estimator of the Sharpe Index is:

$$sh=\bar{r}/s(r).$$

That this estimator is, in fact, biased was shown by Jobson and Korkie [45]. The approximately unbiased estimator is:

$$sh=\bar{r}/s(r) \times 1/[1+(0.75/T)].$$

The estimator of the variance of this statistic is:

$$VAR(sh)=1/T \times \{1+(\bar{r}/\ 2s(r))^2\}.$$

In earlier studies, the Sharpe measure was used only as a ranking device. Not only does this reduce the usefulness of the measure for comparative purposes, but also could lead to erroneous conclusions if the realized capital market line

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[45] Jobson,J.D. and Korkie, B.M. (1981): Performance hypothesis testing with the Sharpe and Treynor measures, *Journal of Finance*, Vol. 36, No.4, pp. 889-908.

was downward sloping in the period of observation [46]. Jobson and Korkie provided a statistic for testing the hypothesis:

H_0:SH-SH(market proxy)=0

which is defined as:

$$shm=[s(m) \times (\bar{r})]-[s(r) \times \bar{m}_0].$$

This can be standardized by dividing by the estimated standard deviation of the distribution to yield a statistic that is approximately normally distributed. This z-statistic is referred to as zsh in this study.

Like the Jensen and Treynor Indexes, the Sharpe measure may be correlated with its risk proxy—in this case, standard deviation of returns. Klemkosky [47] found a relatively strong relationship between estimated Sharpe Index and its associated risk estimator. Chen and Lee [48] studied this further and showed that the estimated Sharpe measure is in general correlated with the variability in return, with the sign and degree of correlation dependent on the number of observations used to estimate the measures, the investment horizon, and the market conditions in the interval of study.

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[46] For a discussion of this problem see:
Tiniç, S.M. and West, R.R.(1979): *Investing in Securities: An Efficient Markets Approach*; Addison-Wesley Publishing Company,Inc., pp. 550-551.
[47] Klemkosky, R.C.(1973): The bias in composite risk measures; *Journal of Financial and Quantitative Analysis*; Vol.8, pp. 505-514.
[48] Chen, S-N. and Lee, C.F.(1981): The sampling relationship between Sharpe's performance measure and its risk proxy: sample size, investment horizon and market conditions; *Management Science*; Vol. 27, pp. 607-618.

Reservations in using the performance measures

The significance of a correlation between a performance measure and its risk proxy depends to a certain extent on how the measures are used. Such a relationship may not affect the use of an Index as a ranking device if it can be shown that the rankings are unbiased, and the measures will provide useful information about the relative performances. However, a strong correlation between a performance measure and its risk proxy precludes the use of the measures in any tests of significant differences, unless the correlation is compensated for in the tests employed. The correlation between the Sharpe measure and return variability has been shown to vary with market conditions and with investment horizon, so trying to adjust for risk could be a difficult task. Empirical evidence about the correlations between the Jensen and Treynor Indexes and estimated β's was noted to be contradictory, so for these two measures also adjusting for the correlation may not be a simple calculation. Thus before firm conclusions are drawn about the differences in performance of any set of portfolios it is desirable to check for the nature and strength of relationships between a measure and its risk proxy.

A significant reservation about the Jensen and Treynor measures was raised by Roll [49] who concluded that tests of the capital asset pricing model are in effect tests of a

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[49] Roll, R.(1977): A critique of the asset pricing theory's tests; *Journal of Financial Economics*, Vol. 4, pp.129-182.

joint hypothesis that the model is valid and that the market portfolio is efficient. Thus, the only way to verify the model would be to test whether the true market portfolio is *ex post* efficient. Since this portfolio includes all assets including human capital, securities, real estate, and the like, it cannot be directly observed, so performing such a test is virtually impossible. In studies of the model, some index must be used as a market proxy, and Roll showed that if the chosen index is *ex post* efficient, then by the mathematics of the efficient set, no asset can exhibit abnormal performance. If the index chosen is *ex post* inefficient, then abnormal performance will be oberved, but two different inefficient indexes would yield two different results. Thus one cannot conclude that absolutely one fund has outperformed another, should their Jensen or Treynor measures so indicate.

However, realistically, most investors are only interested in the real world situation, and seek information on what is measurable. If the market proxy chosen is commonly accepted as part of the information set on which decisions are based then such comparisons are useful.

D. THE PERFORMANCE OF FUND MANAGERS

As noted in Chapter I, fund managers are not expected to outperform the market consistently, but may consistently outperform other managers. Thus portfolios constructed from the funds a manager holds, either equal-weighted or

value-weighted, are expected to behave no differently than individual funds, in general. The aggregated coefficients method [50] described earlier can be used to estimate the β and jn values, and other measures can be calculated as previously outlined. Equal-weighted portfolios might on average have lower coefficients of determination than value-weighted portfolios, reflecting the lower level of diversification inherent in constructing a portfolio in this manner.

E. OTHER FUND CHARACTERISTICS AND THEIR RELATIONSHIP TO SYSTEMATIC RISK AND PERFORMANCE

The characteristics investigated were objectives, RRSP status, presence or absence of load charge, management fee ratio, fund size, and rate of net new deposits. It was postulated that if a relationship existed between any of these attributes and performance or systematic risk it would be linear, and multiple ordinary least squares regression was used to test for significant relationships. The coefficient of a variable representing an attribute is an estimate of how strongly and in what direction performance and the attribute were related and standard t-tests can be used to test the significance of the relationships.

The null hypothesis for risk is that there is no relationship between risk and any factors except objective.

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[50] Dimson, E.(1979): Risk measurement when shares are subject to infrequent trading; *Journal of Financial Economics*; Vol. 7, pp. 197-226.

The regression coefficient for income funds should be lower than for income and growth funds which should in turn be lower than the regression coefficient for growth funds. However, since objectives are being represented by qualitative variables, it is not necessarily true that increases in the regression coefficient from group to group will be the same.

For performance measures the null hypothesis is that there is no relationship between performance and any of these factors, so the coefficients are tested to see if they are significantly different from zero. However, significant relationships between management expense ratio or fund size would not be surprising, for the following reasons.

In efficient markets that are well developed and allow managers to adjust fund portfolios rapidly, fund size should be unrelated to performance, since funds have sufficient resources to become well-diversified. However, it is possible due to the constraints noted in Chapter II, that smaller funds may actually outperform larger funds. Thus a negative relationship between performance level and fund size could be observed. Alternatively, larger funds may be able to take advantage of economies of scale in their transactions and so management expenses could be relatively less. This could conceivably result in larger funds outperforming smaller funds.

A priori, the rate of growth of a fund should be unrelated to performance, because this is a function of

investor behaviour, not of risk and return. However, if size of fund and proportion of fund invested in cash and short-term notes affect performance, then the rate of net new deposits may influence performance indirectly. If a manager expects growth and reduces his holdings of short-term notes and cash his portfolio may approximate the market portfolio more closely than other funds and his risk-adjusted returns may overall be higher, depending on market conditions. Also, with an expanding asset base there may be more investment opportunities available, as long as the manager has the resources to manage the new capital effectively. Conversely, if the the total assets are shrinking, performance may suffer as the manager converts holdings to cash to pay those redeeming their shares and as his opportunity set is reduced.

There are two schools of thought on the potential relationship between management expense ratio and performance. One hypothesis is that the greater the management expense the worse the return since managers should be spending only the minimum needed to find and maintain a well-diversified portfolio. The other line of thinking is that the more the manager receives the greater the number and the better the quality of the people he will employ to manage the fund, which in turn could improve the returns. Both sets of reasoning suggest that there may be an optimal fee for a given size of fund.

The presence or absence of load charge should in theory have no bearing on fund performance, since the charges are used to compensate sellers. However, this characteristic could influence performance indirectly if performance were related to rate of growth. All things being equal, on average no-load funds and load funds should perform no differently, so over time returns to investors from load funds should be less than returns from no-load funds. If this were true, rational investors would prefer no-load funds, all things being equal, and the rate of growth of no-load funds would be greater than the rate of growth of load funds. An alternate and contradictory hypothesis is that since load charges are an incentive to sellers, the greater the charge the more aggressive the sellers, which could increase the rate of net new deposits if the aggressive sales techniques were successful. The potential relationship between rate of growth and performance has already been discussed. In a multiple regression model including terms for both rate of growth and whether or not a fund was a load fund, it is hard to say which of the two factors would have the significant coefficient if there were a strong relationship between them and between rate of growth and performance.

RRSP status should, like load charge, have no bearing on performance. However, if this designation affects the rate of growth of the fund, this could have an influence on the manager's opportunity set, as for load versus no-load

funds.

Because there are no clear-cut theoretical models defining expected relationships between performance and other variables in the short-term, the analysis is limited in two ways:

1. the chance of misspecification of the model is great, since other variables not included may be important;
2. if relationships are nonlinear, this model may indicate no relationship, leading to acceptance of a false null hypothesis.

Non-linear relationships are theoretically possible. For example, there may be an optimal fund size, given the limitations of the Canadian market, and so both overly large and overly small funds could perform less well than funds that are more closely optimal. Similarly there may be an optimal management expense ratio that could also be a function of fund size. The model could be expanded to include terms that might account for some types of non-linear relationships, such as was proposed for testing for timing activities in the capital asset pricing model. These involve transforming the variable to another form, such as converting it to logarithmic form, and estimating the regression. Since there was no justification for starting with a complex model, and no theory to guide in the choice of possible transformations, the model investigated is a simple linear one.

F. THE RELATIONSHIP OF RATE OF NET NEW DEPOSITS TO OTHER FUND CHACTERISTICS

For the purposes of this study it was assumed that any relationships between rate of net new deposits in 1976-1980 and fund attributes in 1971-1975 would be linear if such relationships do indeed exist. Ordinary least squares regression with multiple variables was used to test for significant relationships. The fund characteristics considered as potentially being related were: presence or absence of load charge, RRSP status, rate of new deposits in the first time period, estimated β in the first time period, fund size in the first time period, management expense ratio in the first time period, and performance in the first five years. There is really no theory that clearly specifies which of these factors are expected to be important over the short-term.

If past performance is a useful indicator of expected performance, or if investors believe that it is useful, the relationship between performance and rate of net new deposits will be significant. No other strong relationships are expected in general, all things being equal. It is possible that rate of net new deposits would be negatively related to load charge, since load reduces returns to the investor, if load and no-load funds performed no differently. Alternatively, a positive relationship between load and rate of growth could be observed if this group of funds were more successful in its marketing efforts. RRSP

status and rate of new deposits should also be unrelated, unless there were tax changes that encouraged investors to put more capital into such plans. Fund size and rate of net new deposits in the first five years are expected to be unrelated to rate of new deposits in the second interval, if these factors were unrelated to performance. However, to some investors larger funds may appear less risky and more likely to be better diversified, which could result in a positive relationship. Rate of net new deposits in 1976-1980 is also expected to be unrelated to rate of net new deposits in the previous five years since the latter reflects an out-of-date assessment of the relative values of the various funds. However, some investors could use this as a measure of the quality of the fund as an investment, so a weakly positive relationship could be found. The null hypothesis for management expense ratio is that there is no relationship, but for reasons outlined earlier, a positive or a negative relationship could be observed, depending on the market's estimate of the return per dollar expended.

IV. RESULTS OF EARLIER STUDIES

Numerous studies of mutual funds have examined the performance of the mutual fund industry in the United States. Although these studies are a useful general quide to expected behaviours of Canadian funds, the differences in the capital markets and in the legal and cultural environments in Canada and the USA may cause fund managers to behave differently in the two countries.

A. UNITED STATES STUDIES

The first studies of mutual fund performance and behaviour using modern financial theory were carried out in the late 1960's. Sharpe [51], Jensen [52], and Treynor [53], who all used annual data, found that on average funds did not outperform the market and that there were no strong relationships between performance and other factors not related to risk or return. However, when Sharpe ranked the funds according to management expense ratio and compared this ranking to the ranking obtained from his Index, he noted that good performance tended to be associated with lower ratios.

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[51] Sharpe, W.F.(1966): Mutual fund performance; *Journal of Business*, Vol. 39, pp. 119-138.
[52] Jensen, M.C.(1968): The performance of mutual funds in the period 1945-1964; *Journal of Finance*, Vol. 23, pp. 389-416.
[53] Treynor, J.(1965): How to rate management of investment funds; *Harvard Business Review*, Vol. 43, January-February, pp. 63-75.

The use of annual data for estimating the characteristic lines of mutual funds could yield misleading results because of reduced sample size and the Fisher effect discussed in Chapter III. For example, Jensen found the mean R^2 to be 0.85 and a mean β estimate of 0.84 for a sample of 115 funds. When Mains [54] reexamined mutual fund performance using Jensen's methodology but with monthly data, he found that the funds were less risky than Jensen had estimated and that the funds did better than Jensen had reported but in general did not outperform the market.

A very extensive study was carried out by Friend, Blume, and Crockett [55] who compared the performances of a sample of funds to the performances of portfolios of randomly selected stocks from the New York Stock Exchange. They found that the funds tended to perform less well than equally-weighted random portfolios, with the differences greater for low- and medium-risk portfolios than for high-risk portfolios. However, when mutual fund portfolios were compared to proportionally-weighted random portfolios there was little difference, except that high-risk mutual funds tended to perform better than the random portfolios. They concluded that mutual fund managers were neither more nor less successful decision-makers than the market

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[54] Mains, N.E.(1977): Risk, the pricing of capital assets and the evaluation of investment portfolios: comment; *Journal of Business*, Vol. 51, pp. 371-384.

[55] Friend,I.,Blume,M., and Crockett,J.(1970):*Mutual funds and Other Institutional Investors*; McGraw-Hill, New York, 197 pages.

generally. These researchers also detected no systematic relationships between performance and mutual fund size and management expense ratios.

McDonald [56] used the monthly return data on 123 funds to examine the relationship between performance and objectives in the interval 1960-1969. He found the mean β estimate to be 0.92 and the mean R^2 to be 0.59. Using the Jensen, Sharpe, and Treynor Indexes, he uncovered no evidence of either superior or inferior performance overall. He did note, however, that the Jensen measure in this interval was positively related to estimated β values, but not significantly so at the 5 percent level. The actual relationship from regression anaysis was:

$$\alpha=-0.079+0.143\hat{b}.$$

$$(1.04)\ (1.79)\ R^2=0.018.$$

In essence, he found that the Jensen Index was generally not biased against either high or low risk portfolios.

The most recent investigation was reported by Shawky [57] who assessed the mutual fund industry in the period 1973-1977 using monthly data for 255 funds. His results show that in this interval the industry performed as well as the market as a whole, and that returns corresponded almost exactly to the returns from an equally-weighted New York Stock Exchange Composite Index. He concluded that the

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[56] McDonald, J.G.(1974): Objectives and performance of mutual funds; *Journal of Financial and Quantitative Analysis*, Vol. 9, pp. 311-333.
[57] Shawky, H.A.(1982): An update on mutual funds: better grades; *Journal of Portfolio Management*, Winter, pp. 29-34.

Table 4. Regression statistics, Shawky study

Fund	Item	$\bar{r}$	s(r)	v[1]
a	jn	-0.00036	0.0040	-11.1167
n=255	$\hat{b}$	0.9036	0.2715	0.3005
	R^2	0.7451		
b	jn	-0.00035	0.0044	-12.3251
n=61	$\hat{b}$	1.0495	0.2689	0.2562
	R^2	0.7225		
c	jn	-0.00198	0.0043	-2.1814
n=84	$\hat{b}$	0.9965	0.1715	0.1723
	R^2	0.7895		
d	jn	0.00012	0.0032	25.865
n=64	$\hat{b}$	0.8517	0.1933	0.2270
	R^2	0.8029		
e	jn	0.00192	0.0025	1.287
n=46	$\hat{b}$	0.6128	0.2788	0.4549
	R^2	0.6658		

a: all funds
b: maximum capital gains objective
c: growth objective
d: balanced objective
e: income objective
[1] coefficient of variation

SOURCE: Shawky, H.A.(1982): An update on mutual funds: better grades; *Journal of Portfolio Management*, Winter, pp. 29-34.

systematic risk of the funds had been relatively stable over the interval and that funds were better diversified than in prior periods. The regression statistics are reproduced in Table 4. The categories for classification of funds by objectives are those of the Weisenberger Investment Company. The regression model Shawky used is the excess return model described in Chapter III.

B. CANADIAN STUDIES

The number of Canadian studies is sparse, indeed, compared to the number of studies of United States funds. The first noteworthy examination was that of Quirin and Waters [58], undertaken at the request of the Canadian Mutual Funds Association. These researchers studied not only mutual fund performance, but also other aspects of the mutual fund industry such as competition and investor behaviour. In the section on performance, they computed a measure they designated the "perfect hindsight" index to evaluate the sample of funds. Essentially this measure compares fund performance to the performance of an efficient randomly selected portfolio of the same riskiness. A value of 1.00 for this index would indicate that in the interval of comparison the fund was perfectly efficient. The mean for the fund sample was 0.25. To determine whether this was a satisfactory level of efficiency, they compared the funds to randomly selected portfolios and to portfolios actually held by investors. They concluded that the funds were enabling investors to invest in portfolios that performed better than "self-made" portfolios.

Williamson [59] measured the performance of 37 mutual funds in the period 1961-70. He concluded that generally volatility of the funds had increased over the decade, but

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[58] Quirin, G.D. and Waters, W.R.(1969): *A Study of the Canadian Mutual Funds Industry*; The Canadian Mutual Funds Association, Toronto.
[59] Williamson, J.P.(1971): Performance of Canadian mutual funds 1961-'70; *Business Quarterly*, Autumn, pp. 94-105.

that the rise was relatively small. He found the performance of the funds to be closely related to market performance as proxied by the Toronto Stock Exchange Industrial Index, and detected no nonlinearity in the characteristic lines of the funds. However, he utilized annual return data, so his results, while of interest, are not directly comparable to the findings of this investigation.

In his research Grant [60] used monthly data to study the performance of 19 funds in the interval 1960-1974. Seventeen of the 19 are included in the sample examined in this investigation, and details which allow comparison of the results are provided in Table A-8 in the Appendix. Grant concluded that there were no statistically significant differences in the β estimates from the first and second time periods, using a dummy variable version of the excess returns capital asset pricing model. Employing the Jensen Index to measure performance, Grant found that the funds performed no differently than the market proxy. He did examine the possibility of bias in the Jensen measure by regressing the estimated α values onto the estimated β values. The resultant equation was:

$$\hat{a}=0.0027-0.0048\hat{b}$$

$$(1.3) \quad (-1.84) \quad R^2=0.17$$

His view was that this indicated no significant correlation between the Jensen index and the risk proxy.

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[60] Grant, D.(1976): Investment performance of Canadian mutual funds; *Journal of Business Administration*; Vol. 8, No. 1, pp. 1-10.

V. DATA AND METHODOLOGY

A. DATA

The raw data used to complete this study were:

1. monthly navps for all funds in the interval January 1, 1970 to January 1, 1981;
2. monthly dividends and capital gains for all funds in the interval of observation;
3. percent of fund assets expended on management and administration fees for as many years as possible;
4. fund objectives, RRSP status, management firm, fund size, and whether a fund is "load" or "no-load";
5. rates on 30-day finance company paper;
6. returns on the Toronto Stock Exchange Composite 300 Index, with dividends.

Rates on a riskless asset

The rates on 30-day finance company paper were used as a proxy for rates on a riskless asset. Finance company paper is less than ideal as a proxy for a riskless asset because investors demand a premium for the residual default risk that remains on these private issues. The preferred proxy would be Treasury bills of the correct term. However, the Government of Canada does not issue 30-day Treasury bills, so such a proxy is unavailable. On a monthly basis it is expected that the bias due to default risk will be very small, and will be overshadowed by the variability in the returns on the funds and on the market proxy.

The data were obtained from the CANSIM database. These rates are annualized and were converted to monthly returns using the formula:

$$rf=[(AR)(30/365)]/[1-(AR)(30/365)]$$

where

AR=annualized rate.

Returns on the market proxy

The market proxy used is the Toronto Stock Exchange Composite 300 Index with dividends. This Index is a value-weighted portfolio of the 300 largest Canadian companies traded on the exchange at the time of calculation, where "largest" is determined by quoted market value of shares outstanding. Thus the set of stocks included varies over time. The return data were obtained from the TSE 300 Return Index Manual. The continuously compounded excess return series was calculated by subtracting the natural logarithm of one plus the risk-free rate from the natural logarithm of one plus each return.

Data on the mutual funds

The navps values were collected from the *Financial Post*, the *Toronto Globe and Mail*, or directly from the mutual fund, for a date following as closely as possible the first of the month. The aim was to obtain as close an estimate as possible of the true holding period return for the month.

The data on the dividends and capital gains were obtained from the *Financial Post Record of Dividends* for the

years in the interval of observation.

The monthly returns for each fund were calculated using the formula:

$$rt(t)=[(navps(t+1)-navps(t)+d(t)]/navps(t).$$

The continuously compounded excess returns were calculated as:

$$r(t)=\ln\{1+rt(t)\}-\ln\{1+rf(t)\}.$$

Although approximately 120 funds survived through this period, a complete, reliable record was available for only 103. Table A-1 is a listing of the funds included.

For the first 95 funds listed, there are 120 observations. The remaining eight began operating during 1971 and for these only 114 observations are available.

A few of the funds merged with other funds near the end of the interval of study. Missing returns were estimated for these funds by adjusting the navps values according to the conditions of the merger; for example, if 2.5 shares of fund A were deemed equivalent to one share of the new fund B, the navps for fund B was divided by 2.5 to obtain an estimate of the navps for shares of fund A.

The remaining information was collected from the *Financial Post Survey of Funds* for the years 1970 to 1976, when publication ceased, from the *Financial Post Survey of Industrials* for the years 1980 and 1981, which include information on many of the mutual funds with RRSP status, and from the records of the Alberta Securities Commission, which include annual reports and prospectuses for all funds

whose shares are sold in Alberta.

The method for classifying the funds according to objectives is the author's own. Each fund was subjectively assigned to one of five categories: balanced(1), income(2), income and growth(3), growth and income(4), and growth(5). Fund objectives were gauged from the brief descriptions in the *Financial Post* publications. The categories for tax status and for load charges are respectively: RRSP(1), not RRSP(0) and load(1) and no-load(0). The proxies for fund size in each time period were, respectively, total assets at the end of 1973 and at the end of 1978. Management fees paid in each period were approximated by percent paid in 1971 and in 1976.

The rate of net new deposits is a measure of the rate of growth of a fund. This was estimated for each fund for each year from the monthly data using the formula:

$$DA=\{NAV(y+1)-NAV(y)[1+R]+CD\}X100/NAV(y),$$

where

NAV=total assets of fund at end of year y, for y=1,...,Y;

R=holding period return in year y; and

CD=total capital gains and dividends paid by the fund calculated by taking the sum of all monthly values and dividing by the average number of shares outstanding in the year.

After the riskiness of the funds was estimated, each fund was assigned to a risk class, for the purpose of investigating performance of funds of similar risk as a homogeneous group. The definition of these classes is

arbitrary, so for comparative purposes the endpoints used in this study are those used by Friend *et al* [61] in their examination of the United States mutual fund industry. The categories for systematic risk are: less than 0.5, 0.5-0.7, 0.7-0.9, greater than 0.9. The total risk (defined as the variance of return) categories are: less than 0.00015, 0.00015-0.00022, 0.00022-0.00036, and greater than 0.00036.

Sources of error in the database

The obvious cause of errors is inaccurate transcription by either the data source or by the data recorder or by both. Some of these errors were obvious when the data were inspected, and were corrected, but undoubtably some errors of this type were not found.

A more subtle source of error is in the timing. As noted earlier, funds are obligated by law to recalculate navps only once a month (although many recalculate the value weekly or daily), so a reported value may not reflect the most current market assessment of the fund's worth. As well, if there were delays or difficulties in obtaining the most current value from the fund, the newspaper would publish the most recently received navps, which could be for the previous month. Even if the quoted value was calculated very close to the recording date, if the fund held securities that had not been traded close to that date the navps would include non-current information. This is a particular

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[61] Friend,I. ,Blume,M., and Crockett,J.(1970): *Mutual Funds and Other Institutional Investors*; McGraw-Hill Book Company, New York, 197 pages.

problem for funds specializing in bonds or mortgages or in unlisted stocks. The practice is to take the average of bid and ask prices for bonds and unlisted securities, if available. Mortgages are valued at a principal amount which produces the rate of investment return currently available for such mortgages. Thus the price recorded for a fund could well be out of date.

B. METHODOLOGY

Estimating risk and returns for the funds

The first step in the analysis was to calculate the mean monthly excess return and the sample standard deviation in return for all funds. The first set of regressions were estimated to obtain measures of the systematic risk β and the Jensen Index for all funds. With 120 observations per fund, it was possible to examine and compare the funds in each of two subperiods, 1971-1975 and 1976-1980.

The first model investigated was the time series empirical version of the capital asset pricing model:

$$(\widetilde{rt}-rf)= \alpha+\beta(\widetilde{mp}_0-rf)+\tilde{e}.$$

To test the possibility of the characteristic line not being linear, a second model was postulated for all funds:

$$(\widetilde{rt}-rf)= \alpha+\beta(\widetilde{mp}_0-rf)+ \gamma(\widetilde{mp}_0-rf)^2+\tilde{e}.$$

These models were estimated in each subperiod for each fund by regressing continuously compounded excess returns for the fund onto the continuously compounded returns for the market index using ordinary least squares regression.

Estimating the models for each subperiod independently allows cross-sectional comparisons but does not allow easy comparison of these values across time. To examine this issue a model including dummy variables was also estimated:

$$(\widetilde{rt}-rf)= \alpha+\beta(\widetilde{mp}_0-rf)+ \gamma_1 D+\gamma_2[D(\widetilde{mp}_0-rf)]+\widetilde{e},$$

where D=0 if t=1,60 and 1 if t=61,120.

The value of the Durbin-Watson statistic for many of these first regressions exceeded the upper critical value at the 5 percent level, indicating negative serial correlation in the error term. This suggested either autocorrelation in the fund returns or in the market proxy, or misspecification of the model [62]. Since all returns in this study are economic time series, autocorrelation would be possible [63]

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[62] It is important to note that if autocorrelation in the residual series is indeed due to misspecification of the model (which is not a very palatable alternative, considering the importance of the capital asset pricing model in modern financial theory), then the other assumptions about the error terms, notably that the variance is constant and that the residuals are uncorrelated with the market proxy, may also be violated. Thus it would be worthwhile to investigate the properties of the residual series. To check for correlation between the residuals and the market proxy alternate procedures such as instrumental variables must be used. Some standard tests for heteroscedasticity are Glejser's test and the Goldfeld-Quandt test. These are described in: Judge,G.G., Griffiths,W.E., Hill, R.C. and Lee,T-C.(1980): *The Theory and Practice of Econometrics*; John Wiley and Sons, New York, pp. 145-153.

It was decided not to pursue this line of investigation because of the complexity of these tests, their low power if the form of the heteroscedasticity is unknown, and the promising results from the autocorrelation subproject. However, such tests could provide addition useful information on the reliability of the estimates from these models.

[63] It is certainly true, however, that common stock returns approximate a random walk, and *a priori* there is no reason to expect that portfolio returns would exhibit behaviour

[63]. To check for this possibility the first six autocorrelations of the fund series, the market proxy series, and the commercial paper rate series were estimated.

The method often used to obtain revised estimates of the parameters of a regression model when the Durbin-Watson statistic indicates serial correlation is to estimate a value of the first-order autocorrelation then estimate a first differenced model using this value. However, both the Durbin-Watson statistic and this reestimation method are based on the assumption that the serial correlation can be modelled as a first-order autoregressive process [64]. The autocorrelations of the returns series suggested that this assumption may not be appropriate for these data. Also, as noted earlier, negative autocorrelation has been observed in the residual series of regressions of common stocks on market indexes, and has been attributed to infrequent

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[63](cont'd)that is markedly different, if management strategy is relatively passive and the average relative frequency of trading of the portfolio and the market proxy are roughly equivalent.

A significantly negative first-order autocorrelation for a return series may also indicate an error in the measure of the pricing since the two returns incorporating this error will be of opposite sign.

[64]That the Durbin-Watson statistic is a good method for detecting autocorrelation in general, regardless of the underlying ARIMA process, is noted by Judge *et al* in: Judge,G.G., Griffiths,W.E, Hill, R.C., and Lee, T-C.(1980): *The Theory and Practice of Econometrics*; John Wiley and Sons, New York, pp. 223-224.
However, these authors suggest using a significance level as high as 0.4 to compensate for the "inconclusive region". They also advise testing other ARIMA models, in addition to the first-order autoregressive process when the Durbin-Watson statistic is found to be significant.

trading of stocks on the exchange. Fowler, Rorke, and Jog [65] provided empirical evidence that trading on the Toronto Stock Exchange is indeed "thin". They noted that over 94 months of observation, only 20 percent of the stocks in the TSE 300 Composite Index were traded every closing day for a monthly holding period, while for 6 percent of stocks in the Index trading did not occur as frequently as once per period. For the whole exchange only 6 percent of the stocks were found to trade every closing day for a monthly holding period. These results are consistent with the findings of Dimson [66] who ascertained that infrequent trading is common for stocks on the London Exchange. He showed that one leading and several lagged market terms are needed to adequately account for this when estimating β's for stocks on that Exchange with monthly data. Thus, Dimson's aggregated coefficients method for estimating β's was used in this investigation, with the final model estimated incorporating one led term and two lagged terms [67].

The model for independent regressions in each subperiod is:

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[65] Fowler, D.J., Rorke, C.H., and Jog, V.M.(1979): Heteroscedasticity, R^2, and thin trading on the Toronto Stock Exchange; *Journal of Finance*, Vol. 34, pp.1201-1210.
[66] Dimson, E.(1979): Risk measurement when shares are subject to infrequent trading; *Journal of Financial Economics*, Vol. 7, pp. 197-226.
[67] This resulted in the loss of three observations, the first and the last two, so 59 observations were used in the first interval and 58 in the second when estimating these models.

$$(\tilde{rt}_0-rf_0)=\alpha+\gamma(\tilde{mp}_0-rf_0)+ \gamma_2(\tilde{mp}_1-rf_1)+ \gamma_3(\tilde{mp}_{-1}-rf_{-1})+$$

$$\gamma_4(\tilde{mp}_{-2}-rf_{-2})+\gamma_5(\tilde{mp}_0-rf_0)^2+\tilde{e}.$$

A model including dummy variables was also proposed to allow intertemporal comparisons:

$$(\tilde{rt}_0-rf_0)= \alpha+\gamma_1(\tilde{mp}_0-rf_0)+ \gamma_2(\tilde{mp}_1-rf_1)+$$

$$\gamma_3(\tilde{mp}_{-1}-rf_{-1})+ \gamma_4(\tilde{mp}_{-2}-rf_{-2})+ \gamma_5(\tilde{mp}_0-rf_0)^2+ \gamma_6D+$$

$$+\gamma_7D(\tilde{mp}_0-rf_0)+ \gamma_8D(\tilde{mp}_1-rf_1)+ \gamma_9D(\tilde{mp}_{-1}-rf_{-1})+$$

$$\gamma_{10}D(\tilde{mp}_{-2}-rf_{-2})+ \gamma_{11}D(\tilde{mp}_0-rf_0)^2+\tilde{e}.$$

Both the dummy variable model and the independent models were estimated using stepwise ordinary least squares regression(forward and backward) to find the set of terms that minimized the sum of squared residuals but reduced the problem of multicollinearity as much as possible [68]. The standard F-test for comparing full and reduced models was used to determine whether a more complex model was, in fact, superior to a simpler model.

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[68] The stepwise procedure means simply that either terms are added one at a time until a set probability level for entry is reached, or that terms are removed from a model containing all terms one at a time until a predetermined probability level for removal is reached. The term entered is the one with the highest probability for entry, or the term removed is the one with the lowest probability in the regression. One disadvantage is that once a term is entered(or removed) it is not tested for removal(or reentry). A second difficulty is that the appropriate significance levels for the t-tests and F-tests cannot be determined. Thus the the results must be interpreted with some caution and with consideration for the underlying theoretical principles on which the regression model is based.

When regressor variables in a model are highly correlated the model is said to suffer from problems of multicollinearity. The principal result is that the estimated errors for the estimates of the parameters are made large, so the confidence intervals are made large, and tests of significance will be unreliable.

Even with this extended model, the Durbin-Watson statistic indicated negative serial correlation in the residuals for a number of funds. To examine this problem further the first six autocorrelations of the residuals from the complex dummy variable model and from the independent model for each time period were estimated. The significance of the first six autocorrelations was jointly tested with the Q-statistic [69]. The null hypothesis is that jointly all first six autocorrelations are asymptotically equal to zero.

Estimating the performance measures

The performance measures were estimated using the relationships described in Chapter III. That is, sh, zsh, trr, and ztr were measured for each fund. Also to allow comparison with previous work the unadjusted Treynor measure (labled tr) was also estimated. To examine the bias in each measure the following model was estimated for each performance measure:

$$PF=\alpha+\beta(\text{risk proxy})+\tilde{e};$$

where

PF=performance measure.

The matching PF and risk proxy pairs are:

1. sh, zsh and s(r);

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[69] The Q-statistic is described in
Nelson, C.R.(1973): *Applied Time Series Analysis for Managerial Forecasting*; Holden-Day, Inc, 150 pages.
It was developed by Box and Pierce in
Box, G.E.P. and Pierce, D.A.(1970): Distribution of residual autocorrelations in autoregressive moving average time series models; *Journal of the American Statistical Association*, Vol. 64.

2. jn, tr, trr, ztr and β.

Tests to compare the different performance measures

The funds were ranked according their Sharpe measure, their traditional Treynor measure, their reestimated Treynor measure, and their Jensen measure. The rankings were then compared using Kendall's tau statistic. The rankings in the first time period were compared to the rankings in the second time period using the same statistic, to see if relative performances were consistent over time.

The relationships between performance or risk and other factors

The general model used to study potential relationships between performance or risk and other factors except management firm is:

$$PF=\alpha+\gamma_1 OB1+\gamma_2 OB3+\gamma_3 OB4+$$
$$\gamma_5 RS1+\gamma_6 LD1+\gamma_7 DA+\gamma_8 ASST+\gamma_9 FMG+\tilde{e};$$

where
PF= performance measure or $\hat{b}$;
OB1=1 for funds with income and growth or balanced objectives and 0 for all other funds;
OB2=1 for funds with an objective of income and 0 for all other funds;
OB3=1 for funds with growth and income for an objective and 0 for all other funds;
OB4=1 for funds with growth as an objective and 0 for all other funds;
RS1=1 for funds with RRSP status and 0 for all other funds;
LD1=1 for funds with a load charge and 0 for no-load funds;
DA=mean net rate of new deposits;
ASST=total assets;
FMG=percentage management fee.

The backward stepwise procedure with the probability of removal set at either 0.05 or 0.01 was used to find the best

fit model. This regression, in effect, compares the funds to a base case class of funds, those which do not collect a load charge, are not RRSP's, and have income as their objective. Thus all that could be said if terms for more than one objective class were found to be significant is that the funds in those classes are significantly different from the funds in the base case class. This does not, however, allow conclusions to be drawn about the differences between funds in those classes. To examine this the regressions were repeated using as a base case class those funds with a balanced objective or those with a growth objective which are not RRSP's and do not collect a sales charge when the fund shares are purchased.

The same regressions were reestimated for each interval using only those funds for which $\hat{b}$ was greater than 0.25, to remove from the sample those funds not expected to be highly correlated with the Toronto Stock Exchange (that is, bond funds, mortgage funds, and funds with portfolios consisting predominately of securities traded in markets not highly correlated with the Canadian stock markets).

If a performance measure were correlated with risk, any relationship observed between that performance measure and another fund attribute could actually be reflecting differences in risk in the different classes of that attribute. To test this, the same regressions were also estimated with the risk proxy included as an independent variable, for both the whole sample and for funds with β

estimates greater than 0.25.

Estimating the performance of managers

The performance of firms which manage more than one fund was examined by constructing both value-weighted and equal-weighted portfolios from the funds they manage, then applying the procedures previously outlined. That is, the β's of the "portfolios of portfolios" were estimated using the aggregated coefficients method as for individual funds, then the performance measures were calculated as previously outlined. The performance of the firms were compared across time by using the measures as a ranking device and estimating Kendall's tau for rankings in first and second time periods.

Factors affecting the rate of new net deposits

In this set of analyses, linear relationships between rate of net new deposits in the second five years and fund characteristics in the first five years were tested by estimating the model:

$$DA_2=\alpha+\gamma_1 OB1+\gamma_2 OB2+\gamma_3 OB3$$
$$+\gamma_4 PF+\gamma_5 ASST+\gamma_6 RS1+\gamma_8 LD1+\gamma_9 \hat{b}_1+\gamma_9 DA_1+\tilde{e}.$$

where the variables are as previously defined. This model was estimated for the whole sample and for the subsample of funds with an estimated β over 0.25 in 1971-1975.

VI. RESULTS AND DISCUSSION

A. ESTIMATING RISK AND RETURNS FOR THE FUNDS

The details for each fund are presented in the Appendix. Table A-1 is a listing of funds included in the study sample.

Table A-2 is a listing of mean return, standard deviation, first estimate of β and the final estimate of the β from both the dummy variable regression and the independent regression, for all funds in the sample. The final equations from the dummy variable analysis are presented in Table A-3. The estimated characteristic lines from the independent regressions are recorded in Table A-4. Only those terms for which the estimated regression coefficient was significantly different from zero at the 5 percent level using standard t-tests are shown in the final equation. The t-value for each coefficient is given below the equation to show the significance of the included variables. The estimated R^2 value, the Durbin-Watson statistic, and the Q-statistic for the residuals for each regression are presented in Table A-5. Table A-6 is a listing of the first six autocorrelations for the the returns. Also in this table are the first six autocorrelations for the market proxy and for the commercial paper rates. Table A-7 provides the first six autocorrelations of the residuals from the various regression analyses.

Autocorrelations in the fund series

An estimated autocorrelation coefficient is considered to be significantly different from zero at the 5 percent level if its absolute value is greater than twice its standard error. For 43 funds in the sample at least one of the first six estimated autocorrelations is significant(Table A-6). In this sample, 79 funds(77%) have positive first-order autocorrelations, which is in keeping with the hypothesis that the observed returns represent temporally ordered values of the component securities [70]. This result supports earlier findings that infrequent trading is typical of stocks on the Toronto Stock Exchange. Of the remaining 24 funds with negative first-order autocorrelations, only three (funds 2, 23, and 103) have negative autocorrelations less than -0.1 (the standard error is 0.092), and for only fund 23 is the value significant at the 5 percent level [71]. It is also interesting to note that only 16 funds have positive second-order autocorrelations; for only one of these (fund 90) is the value greater than 0.1.

No attempt was made to identify and estimate the best

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[70]Fisher, L.(1966): Some new stock market indexes; *Journal of Business* Vol. 39(supplement), pp. 191-225.

[71] As noted earlier, negative autocorrelation that is significant can be due to data error; however, for these three funds the navps series looked reasonable on inspection, and for funds 23 and 103 values for the the years 1977-1980 were obtained directly from the company, which provided a yardstick for measuring the accuracy of newspaper quotations in earlier years.

fit ARIMA model [72] for the excess returns series for each fund, because it is not necessarily true that the returns are jointly normally distributed with a constant mean(or mean with a constant trend) and variance. The composition of the portfolios in general changed over time, which could have caused substantial variation in the variance in particular. This is an area of investigation that deserves closer examination, but was beyond the scope of this study.

The existence of significant autocorrelations in these series is in contrast to the findings for common stocks. Fama [73] observed that serial correlations of one-day changes in the natural logarithm of price were significantly different from zero for 11 out of 30 stocks included in the Dow-Jones Industrial Index, but for longer periods the correlations were close to zero, as would be expected if the series approximated a random walk. Possible explanations for some non-randomness in returns from managed portfolios are the infrequency of trading noted earlier, the possibility that rebalancing may take place in jumps, depending on the

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[72]According to theory first developed by Box and Jenkins any time series that is stationary or stationary at some level of differencing can be modelled as a function of previous observations and previous 'disturbance'(the difference between one observation and another in the series)terms. The procedure involves estimating the autocorrelations, partial autocorrelations, and inverse autocorrelations, then estimating a model using these estimates and verifying the model through an iterative procedure. The entire procedure is outlined in
Nelson, C.R.(1973): *Applied Time Series Analysis for Managerial Forecasting*; Holden-Day, Inc., 150 pages.

[73] Fama, E.F.(1965a): The behavior of stock market prices; *Journal of Business*; Vol. 38, pp. 34-105.

manager's investment strategy, the fact that some stocks move together, and the fact that mutual fund share prices reflect transactions costs, while common stock prices do not.

If the efficient markets hypothesis is correct, however, an investor should not be able to use these serial dependencies to "beat the market", after allowing for his transactions costs. This aspect of fund behaviour was not examined here but could be tested using a technical trading filter rule [74].

These results affect this investigation in two ways:

1. serial dependency in the fund series not induced by unique events or data error would mean that estimates of β are both biased and inconsistent, since the "true" return model should include lagged dependent variables;
2. some of the serial dependency observed in the residuals of regressions of these series on market returns is attributable to this dependency in the fund series.

The return series for the riskless asset proxy is nonstationary in this interval, which is typical of interest rate series. However, due to the large variability in the returns series this is of no significance for this study.

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[74] Examples of such studies using daily returns are:
Alexander, S.S.(1961): Price movements in speculative markets: trends or random walks; *Industrial Management Review*; Vol. 2, pp. 7-26.
and
Fama, E.F. and Blume, M.(1966): Filter rules and stock market trading profits; *Journal of Business*, Vol. 39. pp. 226-241.

The autocorrelations for the market proxy were not significant, but the first-order value is weakly negative(-0.02) which is opposite in sign to the value of 0.26 quoted by Dimson [75] for the Toronto Stock Exchange Index.

Risk and return for the funds

The mean excess return in the first time period was -0.0039 and mean standard deviation was 0.0506. The mean excess return on the market proxy was -0.0025 and its sample standard deviation was 0.0511. Thus, overall the funds yielded less than the market, or rather lost more. However, 15 funds had a positive mean monthly excess return in this time period and 34 funds(33%) had means greater than the market.

In the second time period the mean return was 0.0073 and mean standard deviation was 0.0424. For the market proxy, the mean monthly return was 0.010 and sample standard deviation was 0.0526. Thus overall funds yielded less than the market in this time period as well, but mean total risk was less also. The mean monthly excess return for 92 funds was positive, but only 24(23%) returned more than the market. This does not signify, however, that those funds that yielded less performed less well—returns must be adjusted for risk before comparisons can be made.

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[75] Dimson, E.(1979): Risk measurement when shares are subject to infrequent trading; *Journal of Financial Economics*, Vol. 7, pp. 197-226.

From the independent regressions for 1971-1975, in 58 characteristic lines were terms other than the synchronous market term significant. For the second five years, 51 characteristic lines included such terms. This compares to 42 and 53, respectively, from the dummy variable regressions. The autocorrelation results confirmed that fund return series may reflect infrequent trading of a portion of stocks on the Toronto Stock Exchange. Assuming that the navps and the values of the TSE Index were measured at approximately the same times overall, the fact that for about 50 percent of the funds, non-synchronous terms were important indicates that for many funds, average frequency of trading of securities held was different from the average frequency of trading of stocks in the Toronto Stock Exchange 300 Index [76]. That is, some of the prices used to estimate the values of the component securities of these funds were out of date. The consequence for the investor is that published values of β for mutual funds must be viewed with some scepticism. If he is using such values to assess the riskiness of his portfolio he would do well to examine the methods by which these were calculated, to see if some compensation was made for differences in trading frequency.

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[76] Month end data were obtained directly from Guaranty Trust and Montreal Trust for the entire ten-year period. Lagged or led terms appear in the characteristic lines for seven of the nine funds involved. This supports the conclusion that this phenomenon is a function of the market, not of the data.

Relationships between fund returns and market terms were not significant at the 5 percent level for funds 2 and 90 for 1971-1975 and for funds 2 and 6 for 1976-1980. Fund 2 is the AGF Japan Fund, a fund with substantial holdings of non-Canadian securities, so this result is not surprising, since the returns on this fund are likely more highly correlated with returns in foreign capital markets than with returns in Canadian capital markets. Fund 6 and fund 90 are, respectively, All-Canadian Revenue Growth Fund and Royal Trust "B" Fund, two funds which hold a large proportion of their assets in fixed-interest securities, on which returns are in general not well-correlated with returns in equity markets. The result for fund 2 from the dummy variable regression indicates a relationship with only the one-period lag term in the first five years, and no relationship in the second five years. The result for fund 6 from the dummy variable analysis is a value of -0.01 for the second five years. For fund 90 the dummy variable regression indicated a $\hat{b}$ of 0.08 in the first time period.

The characteristic lines of seven funds in the first time period(6.8%) and 13 funds(12.7%) in the second time period included quadratic terms when each time period was examined separately. The equations for 18 funds(17.5%) included a quadratic term when the dummy variable model was estimated. (Of these six applied to the first time period only and 12 applied to both time periods.) A finding of 10 percent or less for an interval is considered to be no

different than the number expected due to random chance. Fabozzi, Francis, and Lee [77] found that for their sample of 85 United States funds only 5.8 percent of the characteristic lines included the quadratic term. The percent for Canadian funds is thus somewhat higher, although the difference is probably not significant. This finding indicates that if managers are engaging in timing activities, they are not being successful enough for the effect to be statistically significant.

The dummy variable analysis indicated that for 43 of the funds the estimated β's over 1976-1980 were not significantly different from the estimated β's over 1971-1975, for three funds the estimated β's were statistically significantly larger in 1976-1980 than in 1971-1975, and for 56 funds the estimated β's were statistically smaller in the second five years. Thus overall the volatility of the funds was significantly lower in the second time period. The decrease in volatility of 55 percent of the funds is consistent with the relative increase in percent of bonds and mortgages held (see Table 1) and with the need for the funds to maintain relatively high levels of cash, since during 1971-1980 redemptions exceeded deposits in all years except 1980 [78].

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[77] Fabozzi, F.J., Francis, J.C. and Lee, C.F.(1979): Generalized functional form for mutual fund returns; *Journal of Financial and Quantitative Analysis*; Vol. 15, pp. 1107-1119.

[78] Canadian Securities Institute(1980): *Canadian Mutual Funds*; p. 70.

Grant [79] found no statistical evidence of a major shift in fund volatility in the interval 1960-1974 in a sample of 19 funds. Seventeen of his sample were also included in this study (see Table A-8 for a comparison). Nine(53%) of these 17 funds were significantly less volatile in 1976-1980 than in the prior five years, a figure comparable to the 55 percent for the total sample.

In this study, the estimated β's of 12 funds(15, 23, 79, 81, 83, 85, 88, 90, 92, 95, 100, and 102) were found to be significantly negative in 1976-1980. The dummy variable regressions produced the same result for all of these funds but 79 and 100, for which the estimates were low positive values. All of these except fund 100 are income funds with portfolios consisting predominately of bonds or mortgages. Fund 100 is the Investors Japan Fund.

Significantly negative estimated β's are very uncommon. However, in none of the reported studies were bond β's estimated using the aggregated coefficients method, so direct comparisons are not too meaningful. The estimates that are analogous are those from the first model studied, the capital asset pricing model with a synchronous market term only. These values for 1976-1980 were:(the starred values were not significant at the 5 percent level): 0.05*(15), 0.07*(23), 0.16(79), 0.08*(81), 0.05*(83), 0.04*(85), 0.05*(88), 0.04*(90), 0.10(92), 0.04*(95),

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[79] Grant, D.(1976): Investment performance of Canadian mutual funds: 1960-1974; *Journal of Business Administration*; Vol. 8, pp. 1-10.

0.09(100), and 0.08*(102). McConnell and Schlarbaum [80] reported that the β estimate for a portfolio of high-quality United States bonds over the period January 1956 to December 1976 was 0.15, and in subintervals was -0.08*, 0.01*, 0.26 and and 0.23. Bildersee [81] found a mean β estimate of 0.07 for "high-quality" preferred United States stocks in the period 1956 to 1966. Both sets of results are not directly comparable to the results of this investigation because the excess return model was not used but it is gratifying that the observed values are similar. In the first time period the use of the aggregated coefficients method on average raised the estimated β of the bond funds by 0.04. Some change was expected because in general fixed income securities tend to trade less frequently than equity issues. The question is why during the second five years were the estimated bond portfolio β's so negative?

Using the results of Jarrow [82], Rao[83] showed that the β of a bond is equal to:

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[80] McConnell, J.J. and Schlarbaum, G.G.(1981): Returns, risks, and pricing of income bonds, 1956-76 (Does money have an odor?); *Journal of Business*, Vol. 54, pp. 33-63.
[81] Bildersee, J.S.(1973): Some aspects of the performance of preferred stocks; *Journal of Finance*, Vol. 28, pp. 1187-1202.
[82] Jarrow, R.A.(1978): The relationship between yield, risk, and return of corporate bonds; *Journal of Finance*, Vol. 33, pp. 1235-1239.
[83] Rao, R.M.(1982): The impact of yield changes on the systematic risk of bonds; *Journal of Financial and Quantitative Analysis*, Vol. 17, pp. 115-127.

β=COV[rt,mkt]/VAR(mkt)=-D(t)r[COV(r,mkt)]/VAR(mkt)

where

D(t)=an approximation to bond duration [84];
r=bond yields; and
mkt=returns on the market.

Since the β of a portfolio reflects the β's of its constituents, this expression is applicable also to the estimated β of a bond portfolio.

The results of the regression analysis show that in the first five years the estimated β's were low and positive. The duration of a bond, D(t), will always be equal to or greater than zero and yields will be positive since they are simply the discount rate that makes the present value of the promised future cash flows equal to the bond's current price. This implies, therefore, that in the first five-year interval bond yields and returns on the market had a negative covariance. That is, returns on the market rose when yields declined. In the second-five year interval,

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[84] Duration was defined by Macaulay as:

$$\text{Duration}(t) = \sum_{T-t-k}^{T-t} [nCP(n)/B(t)]+[(T-t)AP(T-t)/B(t)],$$

where
T=maturity date of the bond;
P(n)=present value of $1 received at time n where the $1 has the same risk characteristics as the cash flow from owning the bond at time t;
C=coupon payment on the bond in dollars
k+1=number of coupon payments remaining;
A=face value of the bond;
B(t)=market price of the bond at time t. in:
Macaulay, F.(1938):*Some Theoretical Problems Suggested by Movements of Interest Rates, Bond Yields, and Stock Prices in the United States since 1856*; National Bureau of Economic Research, Columbia University Press.

The D(t) in Rao's equation is an approximation because exp(-rn) is used to estimate P(n).

however, the β's were negative. This suggests that during the second-five year period bond yields and market returns rose together. During this period the interest rates increased sharply, greatly reducing the prices on bonds and mortgages. However, the prices on stocks generally rose during this time period as the Canadian economy recovered from a recession that began in 1974 and did not end until early 1978 [85]. The selling pressure on medium- and long-term bonds was also probably exacerbated by the instability in the differential between yields on short-term paper and longer-term debt. In March 1978, for example, the rate on 30-day prime corporate paper was 7.95 percent and the yield on long-term corporate bonds was 10.02 percent. Equivalent figures for March 1979 were 11.32 and 10.53 percent respectively and for March 1980 were 14.15 and 14.18 percent respectively. In December 1980 the respective values were 18.35 and 13.63 percent [86].

The significant terms in the characteristic lines of these funds provide additional information on the shift in correlation between the stock and the bond markets. In the first five years, in the independent regressions, the synchronous market term was significant for all funds except

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[85] Murphy, L.J., Laurie, N.M., Simard, C. ,and Durand, R.(1977): Perspectives on the Canadian economy: an analysis of cyclical instability and structural change; The Conference Board in Canada, Technical Paper No. 2, 100 pages.

[86] All these values are from:
Bank of Canada:(1981): *Bank of Canada Review*; January, p. 20.

fund 23, and for funds 15, 81, 83, and 103 was the only signifcant term. In the second five years for only one of these funds(fund 92) was the synchronous market term significant and in every case the coefficients for both lagged terms(the two previous periods) were significant at the 5 percent level. In the first interval the mean R^2 for these funds was 20 percent, while in the second it was 34 percent, an increase despite the lack of a synchronous market term.

A term representing the two-period lag was in the characteristic lines of five funds(12, 19, 32, 36, 41 ,77) for the first five years. For 1976-1980 the number that include this term was 24 (the funds noted plus 1, 7, 14, 19, 27, 37, 47, 63, 66, 69, 97, 103). In the first period the number is no different than what would be expected from random chance. However, the number in the second interval is significantly more than would be expected in normal times, but less remarkable if the correlation between stock returns and yields were positive as the estimated β's for the bond funds seems to suggest.

It appears from the evidence in the literature that a positive correlation between yields and returns on a market proxy of stocks only may be anomalous compared to long-term market conditions. If so, this points out a potential difficulty in using such a proxy. It may be that if the proxy had included both stocks and fixed-income securities, the change in volatility would have been less marked.

Further investigation is needed to examine the basic relationship between bond and stock markets in Canada before firm conclusions are drawn from the results of this investigation.

Level of diversification

The mean R^2 value for the whole sample is 0.54. Values for this measure ranged from 0.04 to 0.96. If funds in the lowest risk class in the second interval are excluded (leaving 71 funds), the R^2 is 0.62. The mean R^2 from the independent regressions for the 17 funds that were also in Grant's [87]. study is 0.66. The comparable value from the dummy variable analysis is 0.62. These are marginally higher than the R^2 of 0.52 found by Grant indicating that the use of the aggregated coefficients method did lead to improved estimates. However, the 0.54 value for the whole sample is considerably less than the 0.75 found by Shawky [88] for United States funds in the period 1973-1977 using the capital asset pricing model with synchronous market terms only. As a measure of the level of diversification, the R^2 indicates that in general Canadian funds had a relatively low level of diversification and were less diversified than comparable United States funds.

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[87] Grant, D.(1976): Investment performance of Canadian mutual funds: 1960-74; *Journal of Business Administration*, Vol. 8, pp. 1-10.
[88] Shawky, H.A.(1982): An update on mutual funds: better grades; *Journal of Portfolio Management*, Winter, pp. 29-34.

Autocorrelation in the residual series

Despite the use of the aggregated coefficients method, serial correlation in the residual terms was not eliminated. The Durbin-Watson statistic for 28 dummy variable regressions indicated significant serial correlation at the 5 percent level. The critical value for the chi-squared distributed Q-statistic is 12.60 for six degrees of freedom, and for 30 funds the Q-statistic was also significant confirming what the Durbin-Watson statistic indicated. Some of this serial correlation is attributable to autocorrelation in the fund series. However, some of the significant values were for funds which did not exhibit significant autocorrelation. This could mean that more lagged or led terms are required in the model(this would be difficult to accept on theoretical grounds, however. Alternatively, it might be useful to estimate β's for a proxy that included both stocks and fixed interest securities to see if some of the serial correlation could be eliminated.

Results by risk class

The results by risk class are given in Tables 5A and 5B.

As expected from capital market theory and the capital asset pricing model, the absolute value of returns increased with increasing risk. The observed trend to decreasing return with increasing risk in the first time period indicates that the realized security market line was

Table 5A. Fund data, by risk class, β estimated from dummy variable regressions

Risk class	Number	Mean β	Mean return	Mean SD	Mean R^2
1971-1975					
β(1)	16	0.19	00.0008	0.0285	0.27
β(2)	10	0.63	-0.0038	0.0511	0.49
β(3)	38	0.83	-0.0035	0.0526	0.61
β(4)	39	1.08	-0.0062	0.0608	0.60
Var(1)	17	0.29	-0.0017	0.0242	0.34
Var(2)	21	0.80	-0.0033	0.0436	0.72
Var(3)	41	0.89	-0.0035	0.0529	0.58
Var(4)	26	1.08	-0.0068	0.0743	0.48
Total	103	0.81	-0.0039	0.0506	0.54
	Min	0.07	-0.0188	0.0099	0.04
	Max	1.64	00.0114	0.1192	0.96
1976-1980					
β(1)	32	0.12	00.0031	0.0309	0.40
β(2)	25	0.61	00.0079	0.0443	0.53
β(3)	26	0.82	00.0082	0.0452	0.69
β(4)	20	1.13	00.0118	0.0547	0.60
Var(1)	29	0.17	00.0019	0.0264	0.47
Var(2)	43	0.71	00.0082	0.0432	0.59
Var(3)	25	0.83	00.0108	0.0517	0.57
Var(4)	6	1.19	00.0118	0.0748	0.43
Total	103	0.61	00.0073	0.0424	0.54
	Min	-0.50	-0.0028	0.0125	0.04
	Max	1.43	00.0228	0.1151	0.96

negatively sloped during that interval. This is consistent with the fact that Canada was in a recession in 1974-1978 [89]. A negative security market line was also observed for

[89] Murphy, L.J., Laurie, N.M., Simard, C., and Durand, R.(1977): Perspectives on the Canadian economy: an analysis of cyclical instability and structural change; The Conference Board in Canada, Technical Paper No. 2, 100 pages.

the New York Stock Exchange in this interval by Shawky [90].

The mean estimated β's in the first and second time periods were, respectively, 0.81 and 0.61. Thus overall Canadian mutual funds tended to hold portfolios less risky than the market proxy. This is a quite reasonable finding since most funds held some short- and long-term debt which would lower the systematic risk of a fund relative to the market proxy. In fact in the second five years the reduction would be considerable, since the bond portfolio β's estimated against the TSE 300 Index were found to be significantly negative. That the shift in volatility was major is indicated by the relative change in the number of funds in each category. From the dummy variable analysis, only one fund moved to a higher systematic risk class (fund 103), but 17 moved one class lower, nine moved two classes lower, and six moved from the highest systematic risk class to the lowest systematic risk class. This change over the decade means that the investor with a relatively long investment horizon is assuming an additional, not easily accounted for, risk when he purchases mutual fund shares—the risk that over time the riskiness of his portfolio may change to a level that may not be suited to his needs. One interesting point is the contrast in the patterns of R^2 between systematic risk and total risk classifications. For systematic risk, the mean R^2 was

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[90] Shawky, H.A.(1982): An update on mutual funds: better grades; *Journal of Portfolio Management*; Winter, 1982, pp.29-34.

Table 5B. Fund data, by risk class, β estimated from independent regressions

Risk class	Number	Mean β	Mean return	Mean SD
1971-1975				
$\beta(1)$	17	0.18	00.0008	0.0279
$\beta(2)$	12	0.63	-0.0049	0.0518
$\beta(3)$	29	0.83	-0.0035	0.0496
$\beta(4)$	45	1.04	-0.0057	0.0574
Var(1)	17	0.28	-0.0017	0.0242
Var(2)	21	0.82	-0.0033	0.0436
Var(3)	41	0.90	-0.0035	0.0529
Var(4)	26	0.99	-0.0068	0.0743
Total	103	0.79	-0.0039	0.0506
	Min	0.01	-0.0188	0.0099
	Max	1.48	00.0114	0.1192
1976-1980				
$\beta(1)$	35	0.08	00.0036	0.0306
$\beta(2)$	34	0.60	00.0079	0.0469
$\beta(3)$	22	0.81	00.0088	0.0474
$\beta(4)$	25	1.10	00.0134	0.0549
Var(1)	29	0.12	00.0019	0.0264
Var(2)	43	0.71	00.0082	0.0432
Var(3)	25	0.77	00.0108	0.0517
Var(4)	6	0.87	00.0118	0.0748
Total	103	0.52	00.0073	0.0424
	Min	-0.50	-0.0028	0.0125
	Max	1.45	00.0228	0.1151

highest for the funds with most systematic risk. However, for total risk, the funds with the highest mean level of diversification were in the middle two categories. This makes intuitive sense in terms of portfolio composition: funds with low total risk tend to specialize in income-producing securities so will appear less diversified

when compared to a market proxy of common stocks. Similarly high-risk funds tend to hold growth stocks, which in the Canadian market are generally stocks of companies in the mining and energy industries or companies that service mining or energy firms.

Relationship of systematic risk to other fund characteristics

To examine whether systematic risk was statistically related to other fund characteristics, the β estimates were regressed onto variables representing these features as described in Chapter III. The features were fund objectives, RRSP status, fund size, whether or not a fund charges a sales fee, and percent management fee. The number of funds by risk class and objectives are given in Table 6. The result of the regression for the whole sample for the period 1971-1975 is:

$$\hat{b}=\underset{(3.81)}{0.37}+\underset{(3.15)}{0.35OB1}+\underset{(4.24)}{0.48OB2}+\underset{(6.42)}{0.56OB4}+$$
$$\underset{(0.44)}{0.027LD1}-\underset{(-0.07)}{0.0039RS1}-\underset{(-1.22)}{0.52X10^{-6}ASST}-\underset{(-0.20)}{0.0099FMG}. \quad R^2=0.46$$

After applying the backward elimination stepwise procedure to eliminate non-significant terms, the reduced model for the whole fund sample is:

$$\hat{b}=\underset{(4.21)}{0.30}+\underset{(3.88)}{0.40OB1}+\underset{(5.55)}{0.54OB2}+\underset{(8.07)}{0.63OB4}. \quad R^2= 0.45$$

This result says that 45 percent of the observed variability in the β estimates for the first time period can be explained by differences in the objectives of the funds. It also says that the mean β value of funds with an income

Table 6. Fund objectives, by systematic risk class

Risk class	Balanced[1]	Income	Growth and income	Growth
1971-1975				
$\beta(1)$	2	11	0	3
$\beta(2)$	3	1	3	3
$\beta(3)$	4	0	9	25
$\beta(4)$	3	2	3	30
1976-1980				
$\beta(1)$	5	12	4	10
$\beta(2)$	3	2	4	16
$\beta(3)$	2	0	5	19
$\beta(4)$	2	0	2	16

[1]Includes funds with a balanced objective or with an income and growth objective

objective was 0.30 and that the the mean β estimates for funds with objectives of balanced growth and income, or growth and income, or growth were significantly larger than the mean β estimate for funds with an income objective. No conclusion can be drawn about the significance of the differences between the other three groups. The mean β value was highest for funds(0.93) with a a growth objective and lowest for funds with an income objective with the other two in between, as expected. The fact that no other variables are significant is also of interest. It shows that on average the volatility of load and no-load funds, or RRSP and non-RRSP funds, or funds of different asset size were the same. Assuming that systematic risk was not related in some complex, non-linear way to these variables, this

indicates that an investor need not be concerned, for example, that smaller funds are a riskier investment than larger funds.

In the second time period the result for the full model is:

$$\hat{b}=-0.042+0.54OB1+0.74OB3+0.85OB4+$$
$$(-0.33)\ (3.99)\ (5.49)\ (7.94)$$
$$0.071RS1-0.0046LD1-0.17X10^{-6}ASST-0.0015DA-0.054FMG.$$
$$(-0.058)\ (-0.40)\ (-0.86)\ (-0.97)\ R^2=0.46$$

The reduced model is:

$$\hat{b}=-0.058+0.53OB1+0.74OB3+0.84OB4$$
$$(-0.67)\ (4.17)\ (6.22)\ (8.80)\ R^2=0.45$$

Similar conclusions can be drawn for β estimates in the second time period as were drawn for β estimates in the first time period. In the second time period, the mean estimated β for funds with an income objective was negative but not significantly different from zero. Again the relative magnitudes of the regression coefficients are as expected.

A similar regression was estimated using as a base case the no-load, non-RRSP funds with balanced objectives, for the purpose of examining differences among the other three groups. The final equation for the first time period is:

$$\hat{b}=0.80-0.57OB2+0.13OB4.$$
$$(16.9)\ (-6.84)\ (2.30)\ R^2=0.44$$

In the second time period the estimated regression line is:

$$\hat{b}=0.58-0.68OB2+0.19OB4.$$
$$(9.52)\ (-6.27)\ (2.67)\ R^2=0.43$$

Thus in both periods the funds with balanced objectives had a mean β estimate(0.80 and 0.58, respectively) significantly

larger than mean β estimates of the funds with income objective (0.23 and -0.10, respectively and significantly smaller than the mean β of funds with a growth objective(0.93 and 0.77, respectively), but not from funds with growth and income objectives only. In general then for the whole sample, risk and objectives are related more or less as expected.

The regression using no-load, non-RRSP, growth funds as a base case was reestimated using only those funds with a β estimate over 0.25, to see if the relationship differed when only funds with major holdings of Canadian equity issues were considered. The final result for the first time period is:

$$\hat{b}=0.91-0.16OB1.$$
$$(34.82)\ (-2.11)\ R^2=0.05$$

This indicates that for riskier funds, the mean estimated β's for funds with income, income and growth, or growth objectives were not statistically different from each other but were statistically larger than the mean estimated β for funds with a balanced objective. The results for the second time period are:

$$\hat{b}=0.73-0.002DA2.$$
$$(23.17)\ (-1.65)\ R^2=0.01$$

That is, the mean estimated β's for the different objectives categories were not significantly different at the 5 percent level of significance. Some differences reflecting different objectives would be expected, assuming that the ad-hoc classification scheme based on the written descriptions is

reasonably accurate. Thus, either a more rigorous classification scheme is needed or the written descriptions are not a very accurate indication of the goals actually pursued by the fund managers in their overall strategies.

B. PERFORMANCE OF THE FUNDS

The estimates of the Sharpe measure for each fund are given in Tables A-9 and A-10. Those for the Jensen and Treynor measures are given in Tables A-11 and A-12.

The performance measures by risk class are given in Table 7.

Jensen Index

For only seven funds was the Jensen measure from the dummy variable regressions significantly different from zero at the 5 percent level.(See Table A-12 for the values for individual funds). The value was significantly negative for fund 78 and significantly positive for funds 37, 65, and 100, indicating that over the decade fund 78 performed significantly worse than the market and the latter three funds performed better than the market. For funds 4, 32, and 65, the jn measures were significantly positive but the coefficients for the intercept-shift terms were significantly negative. This means that statistically the three funds performed significantly better in the second five years than in the first five years. Overall, according to this measure 94 funds performed no better nor no worse than the market over the ten-year period, and basically

Table 7A. Performance measure by risk class, β estimated from dummy variable regressions

Risk class	Jensen Index[1]	Jensen Index[2]	Sharpe Index	Treynor Index[3]	Treynor Index[4]
1971-1975					
$\beta(1)$	00.0010	00.0000	00.0062	-0.0007	-0.0008
$\beta(2)$	-0.0003	-0.0021	-0.0952	-0.0067	-0.0063
$\beta(3)$	-0.0012	-0.0018	-0.0658	-0.0045	-0.0041
$\beta(4)$	-0.0026	-0.0040	-0.0896	-0.0074	-0.0056
Var(1)	-0.0008	-0.0013	-0.0552	-0.0070	-0.0047
Var(2)	-0.0010	-0.0012	-0.0749	-0.0050	-0.0043
Var(3)	-0.0005	-0.0019	-0.0649	-0.0042	-0.0036
Var(4)	-0.0034	-0.0053	-0.0975	-0.0059	-0.0055
TOTAL	-0.0013	-0.0024	-0.0722	-0.0052	00.0043
Min	-0.015	-0.0200	-0.3308	-0.0552	-0.0420
Max	00.010	00.010	00.2223	00.0460	00.0265
1976-1980					
$\beta(1)$	00.0014	00.0019	00.0591	00.0011	00.0013
$\beta(2)$	00.0002	00.0017	00.1771	00.0164	00.0123
$\beta(3)$	-0.0008	00.0007	00.1786	00.0120	00.0098
$\beta(4)$	-0.0017	00.0018	00.2170	00.0164	00.0107
Var(1)	00.0003	00.0008	00.0424	-0.0054	00.0005
Var(2)	-0.0006	00.0100	00.1865	00.0146	00.0126
Var(3)	00.0013	00.0024	00.2049	00.0200	00.0122
Var(4)	-0.0032	00.0050	00.1556	00.0169	00.0104
TOTAL	-0.0001	00.0015	00.1486	00.0105	00.0089
Min	-0.0100	-0.0130	-0.1614	-0.0670	-0.1037
Max	00.010	00.0160	00.4129	00.0828	00.0441

[1]: estimate from dummy variable regressions
[2]: estimate from independent regression
[3]: as traditionally estimated
[4]: as revised

their performance relative to the market proxy did not change significantly in the second five years relative to the first five years. There were 42 positive values and 59

negative values. On the basis of chance alone 5 percent significant values could be expected, and roughly 50 percent would be positive and 50 percent negative, assuming equal probability for positive and negative values. The conclusion is that over the decade differences in performance between the funds and the market proxy were not significant.

The number of significant jn values from the independent regressions in the first time period is seven. Six were negative (funds 4, 5, 24, 70, 71, 79). One was positive (fund 38). Overall there were 17 positive and 84 negative values, suggesting that at the margin mutual funds did worse than the market in this interval. In the second interval, there were nine significantly positive jn values(funds 4, 7, 32, 37, 41, 57, 65, 66, 97) and one negative value (fund 94). Sixty-four funds had positive measures and 37 negative values. Thus apparently funds did marginally better than the market proxy in the second interval.

To determine whether jn was correlated with its risk proxy, jn values were regressed onto $\hat{b}$. For the whole sample in the first time period (using dummy variable regression values) the best-fit equation is:

$$jn=0.002-0.004\hat{b}.$$
$$(2.14)\quad(-3.00)\quad R^2=0.08$$

For those funds with estimated β's over 0.25 the equation is:

Table 7B. Performance measure by risk class, β estimated from independent regressions

Risk class	Jensen Index[1]	Sharpe Index	Treynor Index[2]	Treynor Index[3]
1971-1975				
$\beta(1)$	00.0030	-0.0012	-0.0024	00.0357
$\beta(2)$	-0.0031	-0.1037	-0.0077	-0.0075
$\beta(3)$	-0.0018	-0.0688	-0.0050	-0.0042
$\beta(4)$	-0.0035	-0.0942	-0.0066	-0.0055
Var(1)	-0.0010	-0.0499	-0.0070	-0.0041
Var(2)	-0.0012	-0.0749	-0.0050	-0.0043
Var(3)	-0.0019	-0.0649	-0.0042	-0.0040
Var(4)	-0.0053	-0.0975	-0.0.059	-0.0218
TOTAL	-0.0024	-0.0722	-0.0052	00.0014
Min	-0.0200	-0.3308	-0.0552	-0.0791
Max	00.010	00.2223	00.0460	00.6318
1976-1980				
$\beta(1)$	00.0026	00.0776	00.0041	00.0551
$\beta(2)$	00.0013	00.1675	00.0131	00.0131
$\beta(3)$	00.0009	00.1830	00.0131	00.0094
$\beta(4)$	00.0015	00.2460	00.0180	00.0124
Var(1)	00.0008	00.0424	-0.0051	00.0118
Var(2)	00.0100	00.1865	00.0146	00.0150
Var(3)	00.0024	00.2049	00.0200	00.0661
Var(4)	00.0050	00.1556	00.0169	00.0148
TOTAL	00.0015	00.1486	00.0105	00.0260
Min	-0.0130	-0.1614	-0.0670	-0.0720
Max	00.016	00.4129	00.0828	00.9647

[1]: estimate from independent regression
[2]: as traditionally estimated
[3]: as revised

$$jn=0.004-0.006\hat{b}.$$
$$(2.14)\quad(-3.00)\quad R^2=0.09.$$

The estimated lines for the second time period are:

$$jn=0.001-0.002\hat{b}.$$
$$(2.04)\quad(-2.60)\quad R^2=0.06$$

and

$$jn=0.003-0.004\hat{b}.$$
$$(2.25)\quad(-2.67)\quad R^2=0.08.$$

These show that over the decade the Jensen measure was biased against higher-risk portfolios, even though this correlation explains relatively little of the variability in the Jensen measure. This could explain the skewed distributions for the first and second time periods. Overall, the funds were more risky in the first five years so, because of the negative correlation, they would appear to have performed relatively worse than in the second five years.

From the breakdown by risk class, however, there is some evidence that the relationship between jn and estimated β may not be exactly linear. In the first interval, funds in $\beta(3)$ class had on average a less negative value than funds in classes $\beta(2)$ or $\beta(4)$. In the second five years the average jn measure for the $\beta(3)$ was lower than that of groups $\beta(2)$ or $\beta(4)$. Which is the anomalous group— $\beta(2)$ or $\beta(3)$?

Sharpe Index

The mean Sharpe Indexes for the fund sample in the two time periods are shown in Table 6, and were respectively -0.0722 and 0.1486. The Sharpe measures of market proxy in the first and second time periods, respectively, were -0.0476 and 0.190. Overall, then, in both time periods the performance of the funds appears to have been inferior to

that of the market.(See Table A-9 for the values for individual funds.)

Over 1971-1975 only one fund(fund 38) was found to to have a transformed Sharpe measure(zsh) significantly positive and no funds had significantly negative zsh values. Over 1976-1980, for only eight funds was the zsh over the critical value. The four signifantly positive values were for funds 12, 32, 57, and 65 and the four significantly negative values were for funds 15, 86, 93, and 102. Statistically then, the funds appear to have performed similar to the market proxy, since the number is no more than expected from random chance. However, in both time periods the number of zsh values that were negative is 70, which is significantly more than expected assuming that there is an equal probability of positive and negative values. This suggests that on average the funds performed marginally less well than the market according to the Sharpe measure. This matches the results for the comparison of the mean Sharpe Indexes of the funds and Sharpe Indexes of the market proxy.

The results of the regression of sh and zsh on the risk proxy are:

1971-1975

1. sh=-0.03-0.77s(r).
   (-1.25) (-1.78) R^2=0.03
2. zsh=0.48-7.14s(r).
   (0.479) (-1.846) R^2=0.03

1975-1980

1. sh=-0.025+4.023s(r).
   (-0.75) (5.41) R^2=0.22
2. zsh=-1.41+25.99s(r).

(-4.62) (3.86) $R^2=0.13$

Thus in the first time period, the correlation between risk and the Sharpe measures was not significant. However, in the second interval the Sharpe measures were significantly biased in favor of higher risk portfolios [91]. However, when the mean Sharpe measures by risk class are compared there is some suggestion that the relationship was non-linear. In the first five years, the mean Sharpe measure was lower for risk class Var(2) than for Var(3). In the second five years the mean Sharpe measures for classes Var(2) and Var(3) were higher than for class Var(4). Over the first interval the group that performed the best was class Var(1). This same group had the lowest mean sh of the four risk groups for the second five years. The returns data reveal that the funds with portfolios composed mainly of Canadian bonds and mortgages had a mean return in the first five years of -0.00036 and in the second of -0.0018. Thus these funds did perform well compared to their equity-holding counterparts

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[91] This is the method that has traditionally been used to check for bias in the Sharpe measure. However, Chen and Lee in:
Chen, S. and Lee C.F.(1981): The sampling relationship between Sharpe's performance measure and its risk proxy: sample size, investment horizon, and market conditions; *Management Science*, Vol. 27, pp. 607-618.
showed that the relationship between the Sharpe measure and standard deviation is in general non-linear, so this method may not be the most appropriate. These results contradict their conclusion that the correlation between sample estimates of Sharpe's Index and risk will be positive when the realized risk-free rate is greater than the return on the market and negative when the reverse is true. However, the sign of the correlation does change, congruent with the notion that the direction of bias depends on prevailing market conditions.

over 1971-1975 and much more poorly than equity funds over 1976-1980. It is likely that if these funds were removed from the the sample, the correlation between sh or zsh and standard deviation in the second five years would be lower, although the data for the risk classes indicate that the direction of correlation would be the same. Overall then from the zsh statistics the conclusion is that the funds performed no differently from the market in either period in general, although marginally in both intervals the performance was worse.

Treynor Index

The values for the Treynor measures and the transformed Treynor measures for individual funds are located in Tables A-11 and A-12 in the Appendix. The numbers of significant values of ztm at the 5 percent level for the first and second time periods were 21 and 23 respectively, which is certainly more than would be expected for a random sample. However, as noted earlier, the power of this measure is uncertain when the estimated β value is calculated using the aggregated coefficients method, so it is difficult to interpret this finding. It might be more useful to choose a lower significance level, say 1 percent, to obtain more meaningful results.

In the first five years 18 of the 21 significant values were negative(funds 4, 5, 16, 24, 35, 36, 46, 51, 55, 57, 58, 60, 62, 65, 70, 71, 76, and 99). The three positively significant values were for funds 26, 38, and 67. Overall

there were 25 positive and 76 negative ztr values.

The distribution is much less skewed in the second five years with 13 positively significant values and 10 negatively significant values. In this interval, 52 ztr values were positive and 50 were negative. Those funds for which superior performance is indicated are 1, 3, 12, 20, 26, 32, 37, 45, 57, 65, 66, 71, and 88. The funds which appear to have performed significantly worse than the market according to this measure in 1976-1980 are 17, 35, 41, 42, 50, 60, 68, 77, 78, and 103. Across time, only five funds performed significantly differently from the market in both intervals. Fund 26 statistically outperformed the market over the ten years, and fund 35 underperformed the market in both intervals. Funds 57, 65, and 71 had significantly negative ztr's in the first five years and significantly positive ztr's in the second five years.

The best-fit lines from the regressions of performance measure on the estimated β value(from the dummy variable model) are:

1971-1975

(a)whole sample

1. $tr=-0.001-0.005\hat{b}$.
   (-0.488) (-1.463) $R^2=0.02$
2. $trr=-0.002-0.003\hat{b}$.
   (-0.91) (-1.455) $R^2=0.02$
3. $ztr=0.69-1.82\hat{b}$.
   (1.63) (-3.72) $R^2=0.12$

(b)for $\hat{b}$ greater than 0.25

1. $tr=0.008-0.015\hat{b}$.
   (2.18) (-3.66) $R^2=0.13$
2. $trr=0.002-0.008\hat{b}$.
   (1.00) (-2.76) $R^2=0.08$
3. $ztr=1.75-2.90\hat{b}$.
   (2.46) (-3.80) $R^2=0.14$

1976-1980
(a)whole sample
1. $tr=-0.004+0.024\hat{\beta}$.
   (-1.34) (5.76) $R^2=0.25$
2. $trr=0.141-0.144\hat{\beta}$.
   (1.86) (-1.40) $R^2=0.02$
3. $ztr=0.87-0.65\hat{\beta}$.
   (1.87) (-1.47) $R^2=0.02$

(b)$\hat{\beta}$ greater than 0.25
1. $tr=0.015-0.0004\hat{\beta}$.
   (5.08) (0.04) $R^2=0.0002$
2. $trr=0.018-0.008\hat{\beta}$.
   (8.08) (-2.87) $R^2=0.09$
3. $ztr=1.21-1.17\hat{\beta}$.
   (1.59) (-1.41) $R^2=0.02$

Similar results for β estimated from the independent regressions are:

1971-1975
(a)whole sample
1. $tr=-0.001-0.005\hat{\beta}$.
   (-0.488) (-1.463) $R^2=0.021$
2. $trr=-0.036-0.045\hat{\beta}$.
   (-2.27) (-2.38) $R^2=0.05$
3. $ztr=0.51-1.47\hat{\beta}$.
   (1.16) (-2.82) $R^2=0.07$

(b)for $\hat{\beta}$ greater than 0.25
1. $tr=0.008-0.015\hat{\beta}$.
   (2.18) (-3.66) $R^2=0.13$
2. $trr=-0.002-0.003\hat{\beta}$.
   (-0.89) (-0.94) $R^2=0.001$
3. $ztr=1.11-2.11\hat{\beta}$.
   (1.33) (-2.29) $R^2=0.07$

1976-1980
(a)whole sample
1. $tr=-0.004+0.024\hat{\beta}$.
   (-1.34) (5.76) $R^2=0.25$
2. $trr=0.047-0.041\hat{\beta}$.
   (2.85) (-1.62) $R^2=0.025$
3. $ztr=0.90-0.72\hat{\beta}$.
   (2.68) (-1.42) $R^2=0.02$

(b)$\hat{\beta}$ greater than 0.25
1. $tr=0.015-0.0004\hat{\beta}$.
   (5.08) (0.04) $R^2=0.0002$
2. $trr=0.017-0.007\hat{\beta}$.
   (6.55) (-1.82) $R^2=0.04$
3. $ztr=0.60-0.34\hat{\beta}$.
   (0.72) (-0.29) $R^2=0.001$

The measures were correlated with β in both five-year spans, but for tr and trr the strength of the correlation differs

according to the overall riskiness of the sample. For tr the direction changes if the low-risk funds are removed from the sample, which is consistent with findings for the sh measure. The direction is negative in all cases but one, as expected from the findings of other researchers. The reason that the trr values do not reflect the negative returns for the funds holding bond or mortgage portfolios is that for these funds the final estimated β was negative as well, so negative returns were divided by negative beta estimates when the revised values were calculated. What is clear is that in general the correlation is not significant and is more or less consistent in direction. The exception is ztr in 1971-1975, which would result in the performance of higher-risk portfolios being underestimated.

The absence of a linear relationship between tr or trr and estimated β for predominately equity funds is illustrated by a comparison of the mean values of the different risk classes. Using dummy variable estimates, over 1971-1975 funds in the risk class $\beta(2)$ had the lowest mean trr value of the highest three risk classes but over 1976-1980 risk class $\beta(3)$ had the lowest among these three classes. Overall, then, for fund portfolios expected to be reasonably well-correlated with the market, trr and tr were generally unbiased measures of performance. For ztr the direction of bias was consistent, even though the strength of the relationship varied according to the riskiness of the sample and the interval over which β was measured. Thus

tests for significant differences should be interpreted with care, but could be useful indicators.

According to the distributions of positive and negative values, in the first five years the funds underperformed the market. Whether the difference was significant or not is not determinable from this measure, since the appropriate significance level is not known. Following the same reasoning, there appears to have been no difference between market performance and overall fund performance in 1976-1980.

Summary of the results for comparisons with the market proxy

When the periods are examined separately using β's estimated from independent regressions, the ratio of negative to positive values for each of these measures for 1971-1975 are 4.9(jn), 2.3(zsh), and 3.0(ztr). For 1976-1980 the comparable values are 0.96(jn), 2.3(zsh), and 0.6(ztr). Even allowing for the bias against higher-risk portfolios in the first interval, this seems to suggest that overall the funds performed worse than the market in 1971-1975 but performed no differently in 1976-1980, when considered from the point of view of an investor with many assets. However, when total risk is considered, at the margin the funds did worse than the market proxy over the whole ten years. However, the differences are apparently not statistically significant since for neither the jn nor the zsh measures were the numbers of funds significantly different from the market more than would be expected due to random chance. For

the ztr measure in both intervals the number of significant values was more than expected through random chance. It should be noted that these comparisons are generally biased against mutual funds, since transactions costs are not considered in calculating returns on the market proxy. Despite this, the funds appear to have performed statistically no differently than the market.

According to all three measures, fund 38 outperformed the market in the first five years. According to the jn and ztr measures but not according to the zsh measure, funds 4, 5, 24, and 71 underperformed the market in this interval. All three measures indicate that in the second five years funds 32, 57, and 65 outperformed the market proxy. By the ztr and zsh measures so did fund 12, and by the jn and ztr measures funds 37 and 66 did also. In this interval no funds had significantly negative values for all three or any pair of measures. The numbers are, as noted, no different from what could occur by mere chance. Not even a single fund was found to have consistently outperformed nor underperformed the market over time. Thus these results strongly support the efficient markets hypothesis for Canadian markets.

Comparison of the rankings of the funds

Table 8 shows the correlation of the rankings of the funds according to the different measures, using Kendall's tau statistic. All values are significant at the 1 percent level.

Table 8. Comparison of the rankings using Kendall's tau

	Sharpe Index (sh)	Treynor Index (tr)[1]	Treynor Index (trr)[2]	Jensen Index (jn)[3]	Jensen Index (jn)[4]
whole sample					
1971-1975					
sh	1.00	0.84	0.86	0.56	0.70
tr	0.84	1.00	0.84	0.49	0.66
trr	0.84	0.84	1.00	0.51	0.66
jn[3]	0.56	0.49	0.51	1.00	0.60
jn[4]	0.70	0.66	0.66	0.60	1.00
1976-1980					
sh	1.00	0.74	0.65	0.25	0.33
tr	0.74	1.00	0.69	0.26	0.39
trr	0.65	0.69	1.00	0.37	0.38
jn[1]	0.25	0.26	0.37	1.00	0.42
jn[2]	0.33	0.39	0.38	0.42	1.00
for $\hat{b}$ over 0.25					
1971-1975					
sh	1.00	0.90	0.88	0.52	0.71
tr	0.90	1.00	0.87	0.54	0.73
trr	0.88	0.87	1.00	0.50	0.69
jn[1]	0.52	0.54	0.50	1.00	0.55
jn[2]	0.71	0.73	0.69	0.55	1.00
1976-1980					
sh	1.00	0.71	0.65	0.41	0.43
tr	0.71	1.00	0.70	0.37	0.49
trr	0.65	0.69	1.00	0.48	0.51
jn[3]	0.41	0.37	0.48	1.00	0.19
jn[4]	0.43	0.49	0.51	0.19	1.00

[1]as traditionally calculated
[2]as revised
[3]from dummy variable regressions
[4]from independent regressions

The relatively lower correspondence between the sh and trr rankings in the second five years compared to the first five years reflects the increased proportion of fixed

interest securities in the fund portfolios. Relative to a market proxy of common stock, such portfolios would appear to be less diversified than in the first five years, and the more the differences in portfolio diversification, the greater the divergence between the two ranking systems.

The Kendall's tau for the comparison of the ranks in the first and second time periods for the whole sample are (significance shown in brackets):

1. sh:-0.11(0.10);
2. tr:-0.0002(0.99);
3. trr(from dummy variable model):-0.08(0.23);
4. trr(from independent regressions):-0.14(0.04)
5. jn(from dummy variable model):0.68(0.001)
6. jn(from independent regressions):-0.04(0.58)

Similar figures for $\hat{b}$ greater than 0.25 in each interval(87 funds) are:

1. sh:0.03(0.65)
2. tr:0.01(0.85)
3. trr(from dummy variable model):-0.04(0.58)
4. jn(from dummy variable model):0.65(0.001)
5. jn(from independent regressions):-0.09(0.24).

Strong correlation for the jn measure from dummy variable regressions is not surprising since for 94 funds the values in the first and second intervals are the same. The negative direction of correlation for the whole sample for all the measures(except the jn from dummy variable analysis) indicates that in general relatively good performers in the

first interval tended to do less well in the second five years and vice versa for relatively poor performers. However, the statistics are generally not significant at the 5 percent level indicating that a fund's rank relative to other funds in the second five years was not predictable from its rank in the first five years. The change in direction of the Sharpe and Treynor measures when the low $\hat{b}$ funds were removed from the sample reflects what was previously observed. The group of funds which changed relative performance most drastically were those with the lower $\hat{b}$'s holding mortgages and bonds.

C. RELATIONSHIP BETWEEN PERFORMANCE AND OTHER FUND CHARACTERISTICS

To test for significant relationships between the performance measures and the other fund characteristics, the performance measures were regressed onto the other features as outlined in the methodology section. Results of these regressions [92] are:

1971-1975

1. sh=-0.092+0.038RS1.
   (-7.95) (2.31) R^2=0.05.

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[92] Stepwise regression with backward elimination was used to find the set of explanatory variables that were significant. That is, variables were removed one by one from a full model that included all terms. What is reported here is the final result for each regression showing only those terms for which the coefficients were significant at the 5 percent level from the t-tests. The results were checked with forward stepwise regression. The F-test for comparing full and reduced models was used to check for multicollinearity that would reduce the significance of individual highly correlated variables.

2. zsh=-0.098-0.33OB4.
(-0.84) (-2.19) R^2=0.05.
3. tr=no terms significant at the five or ten percent level.
4. trr=-0.007+0.004LD1.
(-4.39) (1.69) R^2=0.01
5. ztr=-0.23-0.93OB4.
(-0.87) (-2.70) R^2=0.07

1976-1980

1. sh=-0.05+0.12OB1+0.22OB3+0.20OB4+0.06LD1.
(-2.17) (3.21) (5.82) (7.01) (5.82) R^2=0.49.
2. zsh=-1.43+1.04OB3+0.90OB4+0.70LD1.
(-7.25) (3.39)(4.15) (3.61) R^2=0.35.
3. tr=-0.02+0.25OB1+0.03OB3+0.03OB4+0.009LD1.
(-4.47) (3.78) (4.64) (5.90) (2.57) R^2=0.39
4. trr=no significant terms at the five or ten percent level.
5. ztr=-1.44+1.11LD1+0.76FMG.
(-3.11) (2.57)(2.14) R^2=0.14

The reduced models for funds with $\hat{b}$ greater than 0.25 are:

1971-1975

1. sh=-0.096+0.036RS1.
(-8.09) (2.02) R^2=0.05
2. zsh=-0.48+0.27RS1.
(-4.52) (1.68) R^2=0.03
3. tr=no terms significant at the five or ten percent level
4. trr=-0.005+0.003RS1.
(-6.21) (1.96) R^2=0.04
5. ztr=-1.07+1.08OB3. (-5.25) (2.13) R^2=0.05

1976-1980

1. sh=0.15+0.05LD1.
(8.87) (2.49) R^2=0.07
2. zsh=-0.53+0.66LD1.
(-2.94) (3.00) R^2=0.10
3. tr=0.01+0.004LD1.
(6.80) (2.03) R^2=0.05
4. trr=0.01+0.46X10^{-7}ASST
(12.02) (2.35) R^2=0.06
5. ztr=-1.86+1.50LD1+0.78FMG.
(-3.48) (2.94) (1.97) R^2=0.17

In general for the whole sample in the first five years performance was not strongly linearly related to any single factor. A term not risk-related appears only in the equation for sh, but the explanatory power of this equation is low. For funds with $\hat{b}$ over 0.25, the dummy variable for RRSP

status appears in three out of five equations, indicating that funds with RRSP status tended to outperform funds without such status. However, the difference is only marginally significant at the 5 percent level. Thus for the first five years, the null hypothesis of no relationship between performance and other factors is not rejected.

In the second five years, the relationships between other factors and sh, zsh, and tr are quite strong, with R^2 over 0.35. However in all three cases except for the load term, the explanatory power seems related to the risk-related variables. The base case is no-load, no-RRSP funds with an income objective. These three equations indicate that no-load income funds performed significantly worse than other no-load funds in other objectives classes and load funds. It has already been demonstrated that in the second five years low-risk bond and mortgage funds underperformed the equity funds, so this part of this result is not surprising. The relationships for trr and ztr, measures which account for the negative β's of the low-risk portfolios, include no terms for the objectives, showing that the strong relationships observed for sh,tr, and zsh are reflecting the poor performance of this particular group of funds. This is also evident in the equations for funds with $\hat{b}$ greater than 0.25. None of these estimated lines included terms for objectives. The surprising element is that all equations except that for trr indicate that on average load funds outperformed no-load funds in 1976-1980.

It must also be remembered that these are comparisons to the base case indicated by the omitted variables. To determine whether the means of the included variables are significantly different from each other it is necessary to use one of them as the base case class. In the first period the results indicate no difference among the classes of objectives, except that for both ztr and zsh, the funds with a growth objective have a lower mean performance measure than the other three groups. When a different base case objective was used the results were very similar, supporting this conclusion. For the second time period for sh, zsh, and tr, more that one class of objective is represented in the final equation, indicating that the means of these classes were significantly different from the mean of the base case class. When the regressions were reestimated using funds with a balanced or income and growth objective as the base case, the final equation for sh included the three objectives terms and the final equation for zsh included the three objectives terms, but the equation for tr included only the term for funds with an income objective. This indicates that the mean sh and zsh values for the growth and growth and income classes were significantly higher than the mean values for the funds with a balanced objective or with an income objective. Also the means for the latter two groups were different from each other. However, the mean tr of funds with growth, growth and income, and balanced objectives were not significantly different from each other

at the 5 percent level, but as a group their mean tr was significantly larger than the mean tr of income funds.

To summarize these results, performance has been shown to be not linearly related to fund size, management expense ratio, or rate of growth in net new deposits. In the first five years, considering only equity funds, those with RRSP status tended to outperform those without such status. Similarily in the second time period funds charging a sales fee tended to outperform no-load funds. There is also strong evidence that the income funds underperformed other groups of funds in the second five years.

It was already demonstrated that performance measures were correlated to some degree with risk. It may be that there was a difference in risk between load and no-load funds in the second interval, or between RRSP and non-RRSP funds in the first interval, which caused these factors to appear to be significantly related to the performance measures. To test this, these regressions were reestimated with the systematic risk proxy included. This would also test whether the differences noted among the different objectives classes was risk-related. The results of the tests with the systematic risk proxy included show that indeed the observed relationships for some fund characteristics reflect a difference in risk. For the whole sample, for all measures in the first time period the final model included only the risk proxy at the 5 percent level of significance. The R^2 values were as noted in the discussions

of the correlation between a measure and its risk proxy—generally less than 0.10. Since the equations without the risk proxy yielded inconsistent results, this indicates that the observed relationships are not significant or are reflecting slight differences in risk. In the second time period, for the whole sample the final equation for sh, using funds with a growth objective as a base case was:

$$sh=0.05+0.11\hat{b}-0.12OB2+0.07LD1.$$
$$(2.21)\ (4.08)\ (3.83)\ R^2=0.57$$

For zsh the final equation was:

$$zsh=-1.42+1.01\hat{b}+0.81LD1.$$
$$(-7.69)\ (4.73)\ (4.42)\ R^2=0.34$$

For tr the final equation was:

$$tr=0.009-0.033OB2+0.009LD1.$$
$$(3.34)\ (-6.75)\ (2.88)\ R^2=0.43$$

The equation for tr is no different from what was found using funds in the growth category as a base case, but not including the risk proxy. For sh and zsh the equations without the risk proxy included all objectives terms, indicating significant differences in their mean performance. The inclusion of the risk proxy eliminates all but the terms for the income objectives class, showing that the measures are not completely risk-adjusted, and that income funds did actually underperform all other funds. The term indicating that load funds outperformed no-load funds is also in all expressions, despite the inclusion of the risk proxy.

For funds with β estimates greater than 0.25, the risk proxy term was in all equations in the first time period. In the regressions for sh and trr it was in addition to the term for RRSP status. For tr, zsh, and ztr the β estimate was the only significant variable at the 5 percent level. The explanatory power of the equations was about 0.1-0.15.

In 1976-1980, the best-fit equations for tr, zsh, and ztr including only funds with estimated β over 0.25 were the ones previously identified. That is, for tr and zsh, only the term for load versus no-load funds was significant. For ztr only terms for load and for management expense ratio (the latter barely significant) were in the final equation. The expressions for sh and trr were as determined before plus an additional term for the risk proxy. That is, sh was found to be related to both the load variable and the risk proxy, and trr was found to be related to the risk proxy and to fund size. The explanatory power was changed only slightly.

The results for β estimated from the independent regressions are similar. Using no-load, non-RRSP, growth funds as a base case the final results for trr and ztr are:

1971-1975

(a) whole sample

1. $trr=0.008-0.01\hat{b}-0.010B2.$
   $(2.20)\ (-3.75)\ (-2.59)\ R^2=0.13$
2. $ztr=0.57-1.81\hat{b}+1.020B3.$
   $(1.26)\ (-3.43)\ (2.14)\ R^2=0.14$

(b) for $\hat{b}$ over 0.25

1. $trr=-0.006+0.003RS1.$
   $(-7.61)\ (2.52)\ R^2=0.07$
2. $ztr=1.26-2.37\hat{b}$
   $(1.55)\ (-2.65)\ R^2=0.08.$

1976-1980

(a)whole sample

1. trr=no relationship at the 5 percent level.
2. $ztr=0.04+1.28LD1-1.64\ OB1-1.2\hat{b}.$
   $(0.13)\ (3.10)\ (-2.66)\ (-2.41)\ R^2=0.14$

(b)for $\hat{b}$ greater than 0.25

1. $trr=0.01+0.0004ASST$ [93] $-0.005OB1+0.004LD1.$
   $(6.68)\ (2.04)\ (-2.02)\ (2.26)\ R^2=0.16$
2. $ztr=-0.50+1.64LD1-2.58OB1.$
   $(0.25)\ (3.17)\ (-3.14)\ R^2=0.21$

The most striking difference between these results and the results from the dummy variable analysis is the presence for a term for funds with a balanced objective in the equations for the second five years. That is, these equations are saying that the mean trr and ztr measures for funds with income or growth and income objectives were not significantly different from the mean for growth funds, but the mean for balanced funds was significantly lower, even when risk was accounted for. This is probably a function of their portfolio compositions, which include both fixed interest securities and equity issues. The former were shown to have negative returns in this interval in general, which would reduce the mean returns for balanced funds. The estimated β's would also be reduced, of course, but if the former were proportionally greater, the risk-adjusted returns would be lower than for funds of predominately equity issues. The term for load funds is in the expressions for the second five years, consistent with the results for β estimated from dummy variable analysis.

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[93]Total assets were scaled by dividing by 1,000,000 in this equation

Why load funds as a group should have outperformed no-load funds in this interval is somewhat problematic. Theory suggests that there should be no difference since this factor is unrelated to a manager's activities in controlling the funds assets. Even if it is assumed that market pressures would work to eliminate the less efficient load funds (investors would want returns to compensate for the extra cost, all things being equal), it has already been shown that no manager was able to perform consistently better or worse than his peers. How, then, could the managers of load funds as a group have had the knowledge to compensate, at least partially, those who chose these instead of no-load funds? The mean return for no-load funds(38 funds) was 0.005 while for load funds the mean return was 0.009(65 funds). For the first group the mean standard deviation was 0.041 and for the second it was 0.045. The chi-squared value for the comparison of the distributions of load and no-load funds by risk class was 5.05 with a significance of 0.17, so there was apparently no difference in unsystematic or systematic risk between the two groups. The difference was in the mean returns. On an annualized basis the difference was about 5 percent. The maximum load charge is about 9 percent so the load funds still likely returned on average less to the holders of these funds but, without measuring the holding period returns and without knowing an individual's investment horizon, it is difficult to assess whether this difference

would translate into above average returns to an investor.

In the first time period the RRSP funds had a lower mean β estimate(0.74 compared to 0.87), a lower mean standard deviation(0.046 compared to 0.057), and a higher mean return (-0.0027 compared to -0.0051) than non-RRSP funds. Thus it is not surprising that the average performance measures of this group were higher, especially since the measures in the time period were marginally biased against higher risk portfolios.

D. PERFORMANCE BY FUND MANAGER

The list of fund management groups and the funds they manage is given in Table A-13. As noted previously both equally-weighted and value-weighted portfolios were formed from the funds controlled by a management group. The data on these portfolios and the outcomes from the dummy variable regression model and from independent regressions in each time period are given in Tables A-14 and A-15. The autocorrelations [94]

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[94] It was noted earlier that if the underlying price series were temporally ordered due to infrequent trading of a portion of the component stocks, positive first-order autocorrelations would be observed. For the funds as a whole 78 percent of the funds had positive first-order correlations and 84 percent had negative second-order autocorrelations. For 16 of 18 value-weighted portfolios the first-order autocorrelations were positive. The remaining two values(for M3 and M18) were negative but not significantly different from zero. For the equally-weighted portfolios all but one first-order autocorrelation were positive and the exception, for M3, was not significantly different from zero. The second-order autocorrelations for all portfolios were negative. One of the first six autocorrelations was greater than twice the standard error

[94] for the portfolio returns series and for the residuals can be found in Tables A-18 and A-19 The data for the portfolios in aggregate are given in Table 9. The results are for 114 observations, not 120, because some of the portfolios included funds which began operating in 1971.

Risk and return for the portfolios

The mean market return in 1971-1975 was -0.003 with a standard deviation of 0.051. Mean return on the funds was -0.004 with a standard deviation of 0.051. Overall the portfolios returned less than the market or the whole sample and had lower risk than either the whole fund sample or the market. In this interval the returns on all portfolios except the the value-weighted and equally-weighted portfolios of manager M11 were negative. The mean return was negative but higher than the mean return on the market for value-weighted portfolios of managers M10, M12, and M17. Among the equally-weighted portfolios, the mean loss was less than the loss on the market for managers M3, M10, and M12.

In 1976-1980 the mean market return was 0.010 with a standard deviation of 0.053. The mean return on all funds was 0.007 and mean standard deviation was 0.042. The portfolios and the funds as a whole were similar in return, but the portfolios were less risky, as expected from their

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[94](cont'd)for 10 out of 18 value-weighted portfolios(M1, M2, M5, M6, M7, M8, M9, M14, M15, and M18) and for 11 out of 18 equally-weighted portfolios(M1, M2, M4, M5, M7 M8, M13, M14, M15, M16, M18). This is consistent with the results for the whole sample of funds.

Table 9. Aggregated data for fund manager portfolios, dummy variable analysis

Group	Mean β	Mean return	Mean SD	Mean R^2
VW1	0.79	-0.005	0.043	0.71
VW2	0.65	00.007	0.035	0.71
EW1	0.85	-0.006	0.045	0.71
EW2	0.62	00.007	0.035	0.71

Group	Sharpe Index	Treynor Index[1]	Treynor Index[2]	Jensen Index
VW1	-0.119	-0.008	-0.011	-0.002
VW2	00.176	00.012	00.008	-0.001
EW1	-0.135	-0.009	-0.007	-0.003
EW2	00.192	00.016	00.012	-0.000

VW1: value-weighted portfolios, 1971-1975
VW2: value-weighted portfolios, 1976-1980
EW1: equally-weighted portfolios, 1971-1975
EW2: equally-weighted portfolios, 1976-1980
[1]as traditionally estimated
[2]as revised

higher level of diversification. All portfolios, except the value-weighted portfolio of manager M17 had positive mean returns in this period. The value-weighted portfolios of managers M1, M15, and M16 yielded higher returns than the market. Among the equal-weighted portfolios, those of managers M1, M8, M15, M16, and M18 returned more than the market. These results are in accord with the findings for the whole sample.

From the dummy variable regression, the characteristic lines of all portfolios except the value-weighted and

equal-weighted portfolios of manager M13 included lagged or or led terms. Quadratic terms were significant in the equations for the value-weighted portfolios of managers M9, M10, and M17 and for the equal-weighted portfolio of manger M4. In the independent regressions for the first interval, 13 of 18 for value-weighted portfolios and 13 of 18 for equally-weighted portfolios included lagged or led terms. Quadratic terms were significant in the characteristic lines for the value-weighted portfolios of managers M9 and M17 and for the equally-weighted portfolio of manager M10. Similarly for the second interval, the characteristic lines for only three value-weighted portfolios did not include lagged or led terms and the lines for only three equally-weighted portfolios did not include such terms. In this interval a quadratic term was significant for only one portfolio. Taken together these results support the conclusion that managers were generally not successful at timing the market and that the average frequency of trading was not the same for funds as for the market proxy.

A term representing the two-period lag was not significant in any of the characteristic lines for the first five years, but was in 9 of 18 value-weighted portfolio lines and in 9 equal-weighted portfolio lines for 1976-1980. This is consistent with the fact that many of these portfolios included funds that held primarily bonds or mortgages. The equations for income funds holding this type of asset were shown to all include a two-period lag term and

the presence of such a term in these equations indicates that the portfolio held a considerable portion of its assets in these types of securities. Not all equations that included a two-period lag included a one-period lag, which would appear to be intuitively unreasonable. However, if for one part of of the portfolio the coefficient of the one-period lag term were negative (the income part) and for the other were positive(the equity part) as would be expected if the equities were trading on average less frequently that the market proxy on average), the net relationship could be no relationship or a relationship not strong enough to result in the one-period term being significant in the final characteristic line.

The decrease in volatility noted for the whole fund sample is clearly evident from these results. The dummy variable analysis indicates that the β's for 13 value-weighted portfolios and for 11 of the equally-weighted portfolios were significantly lower in the second period than in the first period. By risk class the distribution for 1971-1975(value-weighted) was: $\beta(1)$–1;$\beta(2)$–5;$\beta(3)$–9;$\beta(4)$–3. For 1976-1980 the comparable figures are 5, 7, 3, and 3. The figures for equally-weighted portfolios for the first interval are 1,5,6, and 6; and for the second five years are 6,8,2, and 2. This is consistent with the findings for the whole sample and with the shift in assets to a greater proportion of bonds and mortgages.

Performance of the manager portfolios

(a)Performance in the first five years

According to the transformed Sharpe measure, no portfolios significantly outperformed the market, but both the value-weighted and equal-weighted portfolios of manager M4 significantly underperformed the market as did the equal-weighted portfolio of manager M18. However the distribution of positive and negative values suggests that in this interval the portfolios performed worse than the market. Out of 36 values, only three were positive—for the value- and equal-weighted portfolios of M11 and for the value-weighted portfolio of M17.

The Jensen measures from the independent regressions for the value-weighted portfolios of M4 and M10 indicated that these portfolios performed significantly worse than the market. This was also true for the equal-weighted portfolios of these two managers and for the equal-weighted portfolio of manager M18. Thirty-two jn values were less than 0.0, indicating performance inferior to that of the market proxy.

The transformed Treynor measure indicated that in this period the value-weighted portfolios of managers M1, M4, M8, M14, M15, M16, and M18 significantly underperformed the market. For equal-weighted portfolios the underperforming portfolios according to this measure were those of managers M1, M2, M4, M7, M8, M14, M15, M16, M17, and M18. The number of positive values of ztr was three, for the portfolios of manager M11 and for the value-weighted portfolio of M17.

According to all three measures used to compare performance to the market, these managers as a group did worse than the market in 1971-1975. The conclusion was that the funds in aggregate performed worse than the market in this interval, but not significantly worse, so this result for the managers was not unexpected. Also according to all three measures fund manager M4 significantly underperformed the market in this period. For other managers the results are inconsistent.

(b)Performance in the second five years

The standardized transformed Sharpe measure indicated that at the 5 percent level of significance, no fund manager underperformed the market in this subperiod. However, for managers M1 and M15, the zsh values for both value-weighted and equal-weighted portfolios were above the critical value, indicating that these portfolios outperformed the market proxy. There were 12 negative zsh values for value-weighted portfolios and 12 negative zsh values for equally-weighted portfolios. The matches the finding for the whole fund sample: the transformed Sharpe measures for 1976-1980 were predominately negative.

The Jensen values from the independent regressions were all not significantly different from zero at the 5 percent level, except those for the value-weighted and equal-weighted portfolios of manager M1. From the dummy variable regressions, the Jensen measures for the equal-weighted portfolios of managers M1 and M15 were

significantly positive, and in both cases the values for the intercept-shift term were significantly negative at the 5 percent level, indicating significantly different behaviours in the first and second periods. For all 36 portfolios the number of positive values was 11, six for value-weighted and five for equal-weighted portfolios.

The standardized transformed Treynor measures were significantly positive for the value-weighted portfolios of managers M1 and M15 and for the equal-weighted portfolios of managers M1, M8, and M15. Significantly negative values were found for the value-weighted portfolios of fund managers M13 and M14 and for the equal-weighted portfolios of managers M3, M12, and M14. The number of negative values was 10 for value-weighted porfolios and 9 for equal-weighted portfolios. This distribution is similar to the distribution found for the fund sample as a whole.

In sum, according to the distribution of negative and positive values for the jn and zsh measures, the portfolios did marginally worse than the market proxy. However, the distribution of transformed Treynor measures suggests that performance was overall no different. According to all three comparative measures, managers M1 and M15 outperformed the market in this period.

Rankings of the manager portfolios

The Kendall's tau for the comparison of rankings in the first and second time periods for the value-weighted portfolios are (significance shown in brackets):

1. sh:-0.41(0.017);
2. tr:-0.37(0.03);
3. trr(from dummy variable regressions):-0.18(0.31);
4. jn(from dummy variable regressions): 0.39(0.004); and
5. jn(from independent regressions):-0.61(0.001).

For the equal-weighted portfolios the comparable figures are: (significance shown in brackets):

1. sh:-0.16(0.34);
2. tr:-0.20(0.24);
3. trr(from dummy variable regressions):00.09(0.60);
4. jn(from dummy variable regressions): 0.61(0.001); and
5. jn(from independent regressions):-0.17(0.35).

These results suggest that the relative performance of a manager in the first interval was related to his relative performance in the second interval—but inversely. That is, apparently, those that did relatively well in 1971-1975 seem to have performed relatively poorly in the second five years. This fits well with what was observed in the fund sample as a whole. Income funds did relatively better in the first interval and relatively very poorly in the second interval. A number of the managers included are trust companies with large mortgage or bond funds in their keeping. The ranking of these managers in particular could change very drastically from the first to the second intervals. Overall, these results complement what was observed for the fund sample as a whole.

E. RELATIONSHIPS BETWEEN RATE OF NET NEW DEPOSITS AND OTHER FACTORS

In the first interval the mean rates of net new deposits by systematic risk class [95] for β estimated from dummy variable analysis and from independent analysis, respectively, were:

1. $\beta(1)$: 21.25 (15 funds); 23.76 (16 funds);
2. $\beta(2)$: -9.26 (10 funds); -9.35 (12 funds);
3. $\beta(3)$: -5.89 (37 funds); -7.87 (28 funds);
4. $\beta(4)$: -3.25 (34 funds); -3.75 (40 funds).

The corresponding figures for the second five years were:

1. $\beta(1)$: 00.86 (29 funds); 0.78 (32 funds);
2. $\beta(2)$: -4.33 (24 funds); -8.43 (32 funds);
3. $\beta(3)$: -12.95 (25 funds); -12.84 (21 funds);
4. $\beta(4)$: -12.04 (18 funds); -9.56 (11 funds).

The mean value in the first interval was -1.07 with a standard deviation of 21.10. In the second five years the mean was -6.45 with a standard deviation of 21.36.

The mean rates of net new deposits by objectives classes for the first and second five years respectively were:

1. balanced(6 funds): 2.10; -4.04;
2. income(11 funds): 12.12; 0.10;
3. income and growth(5 funds): -12.27; -7.81;
4. growth and income(14 funds): -2.71; -6.60;
5. growth (59 funds): -2.20; -7.74.

Taken together these results indicate that over the decade new investors generally opted for the lower-risk income funds but, overall, rates of redemption exceeded rates of

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[95] The number of funds noted in each category is not the same as noted earlier in the discussion of performance. The slight difference is due to the fact that total assets figures for each year were not available for all funds.

sales.

The hypothesis that prevails is that investors use information rationally and thus should use risk-adjusted rates of return (relative performance) as a primary decision variable, assuming that past performance is a useful indicator of expected performance. However, the theory of investor choice is complex and other factors may influence their decisions as well.

To find out more about investor behaviour a model was estimated in which rates of net new deposits in the second time period were regressed onto variables representing fund characteristics in the first time period. These are: estimated β, asset size, rate of net new deposits, management fee charged, RRSP designation, whether or not the fund was no-load, and the fund objectives.

The final estimated best-fit lines(using $\hat{b}$ from the dummy variable model) are:

whole sample:

1. DA=-11.8+95.9sh+9.8LD1+6.3FMG.
   (-2.81) (4.49) (2.64) (6.28) R^2=0.28
2. DA=-19.24+665.76trr+10.9LD1+7.6FMG+14.53OB2.
   (-4.58) (3.62) (2.71) (2.47) (2.55) R^2=0.27
3. DA=-14.42+1629.29jn+9.27LD1+6.37FMG.
   (-3.57) (4.29) (2.48) (2.09) R^2=0.27

For funds with $\hat{b}$ greater than 0.25 in the first interval the best-fit lines are:

1. DA=-31.1+100.77sh+12.15LD1+8.47FMG+17.23$\hat{b}$
   (-3.55) (4.21) (2.90) (2.68) (2.03) R^2=0.35
2. DA=-17.5+1109.46trr+11.05LD1+8.05FMG.
   (-3.65) (3.74) (2.60) (2.50) R^2=0.31
3. DA=-31.33+1978.04jn+12.3LD1+
   (-3.58) (5.01) (3.04)
   7.08FMG+2.25$\hat{b}$-0.07ASST+22.82OB2.

(2.28) (2.15) (-2.26) (1.92) R^2=0.42

The results for β estimated from independent regressions are very similar so are not repeated here.

Evidently past performance influenced investor decisions strongly, since past performance is a significant explanatory variable. This is an interesting result, considering that relative performance in the period 1971-1975 was unrelated or negatively related to performance in 1976-1980. If this were true for the intervals 1966-1970 and 1971-1975, then investors were using information of questionable value in their decision-making.

It is somewhat surprising that rate of net new deposits in 1976-1980 was related to percent management fee in the first five years and to the fact that a fund charges a load fee. The expectation, all things being equal, is that growth would be negatively related to these fund characteristics, since they reduce the net return to the investor. The presence of the load term might be attributable to the relatively superior performance of the load funds over the second interval, but this would imply that investors detected this so early in the five-year period that rates of growth were affected. If true, the information market must be very efficient, almost beyond the level believable. Another possibility is that the load funds were more successful in their marketing, because of the way they rewarded the sales staff. If the load funds were on average more aggressively marketed, people interested in investing

in mutual funds would tend to choose these funds because of familiarity. This notion is not congruent with the efficient markets hypothesis since it implies that information publicly available is not being used fully by a considerable segment of the market. A third possibility is that the rates of new deposits were no different between load and no-load funds but rates of redemption were dissimilar. Investors in load funds might have been less eager to redeem their shares because of the greater cost they incurred in the initial purchase.

The positive relationship with percent management fee is much more difficult to account for. Performance was found to be not significantly related to this variable in either interval. There is also no systematic difference in the mean values by risk class or objectives class. It may be that investors perceived a higher management expense ratio as an indication of better quality management. Such a belief seems to be without foundation from this study.

The presence of the β terms and the objectives terms agree with the breakdown by class. Investors generally preferred the lower-risk, income funds and these terms reflect that preference.

In sum, these findings are somewhat hard to interpret. Given investor preference for income funds, investors appear to have behaved as expected by the efficient markets hypothesis, since rate of net new deposits in 1976-1980 was found to be significantly related to performance in

1971-1975. This would only be rational, however, if performance were consistent over time and this study indicates that this may not be the case. The positive relationship between rate of net new deposits and load and percent management fee is not what would be expected, all things being equal.

VII. CONCLUSIONS

The focus of this study has been to measure and compare the performances of a sample of Canadian mutual funds in order to help investors make more informed decisions when choosing among investment alternatives, and to provide information on the mutual fund industry in aggregate.

To summarize the findings:

1. The performance measures used indicate that Canadian mutual funds performed statistically no differently than the market proxy in this interval. The distributions of the measures suggest, however, that the funds performed marginally worse than the market in the first five years. Overall, then, fund managers were neither better nor worse on average than the market in predicting general market movements or in finding under- or over-priced securities.
2. When the relative performances of the funds or the fund managers were compared over time the rankings were unrelated or negatively related. This suggests that over time managers did not consistently outperform other managers, but did not consistently do worse, either.
3. The volatility of the funds relative to the market proxy in the second five years was lower than in the first five years, with 55 percent changing to a lower value. This is attributable to the relative increase in the proportion of fixed-interest securities in fund

portfolios, and to the negative correlation between bond returns and stock returns in the second five years. This latter is reflected in the significantly negative β's for 12 funds, 11 of which are bond or mortgage funds. It is likely that if the market proxy included fixed-interest securities, in addition to common stock, the relative decrease would have been less marked.

4. The returns series of the funds exhibit the properties of series based on temporally ordered price movements. This is in keeping with earlier findings that a significant portion of the stocks on the Toronto Stock Exchange was moderately to infrequently traded during the study period.
5. The aggregated coefficients method for estimating β improved the β estimates for 45 percent of the funds, suggesting that the average frequency of trading of stocks in the market proxy was different from the average frequency of trading of securities in the these funds, assuming that the navps and values of the market proxy were measured at approximately synchronous times.
6. The average diversification of the funds as measured by the coefficient of determination from the regressions was low compared to the level of diversification of the market proxy.
7. In general performance was found to be unrelated to mutual fund characteristics, and the relationships that

were found were not consistent over time. The strongest relationships noted were that as a group income funds tended to outperform other funds in 1971-1975, but significantly underperformed other funds in the second five years. There was a significant relationship between performance measure and RRSP status in the first five years, for funds with an estimated β over 0.25. In 1976-1980 load funds outperformed no-load funds.

8. Rate of net new deposits in 1976-1980 was positively related to performance in 1971-1975. This would indicate that the market for Canadian mutual funds was relatively efficient, if past performance had been a useful predictor of performance prior to this time. However, this rate was also positively related to percent management fee in the first five years, and net rate of new deposits was larger for load funds than for no-load funds. This is contrary to what would be expected if investors were considering only risk-adjusted returns in their decision-making.

These findings have a consequence when an individual is making investment decisions. For an investor who has more than just a few assets, the estimated β of a mutual fund is the appropriate measure of risk, and these results suggest that obtaining a reliable estimate of β for mutual funds may be relatively difficult. In general, the volatility of a fund was related to more than just the synchronous market

proxy series, so estimates of past volatility available from the funds directly or from published sources may not be unbiased. In addition, if the return series were autocorrelated, as a number of fund series were, an investor should be sceptical of any β estimate, regardless of the method of estimation, unless the autocorrelation was accounted for. Even a qualitative assessment may not be readily obtainable. There was no strong relationship between written description of objectives and actual systematic risk level for funds with estimated β's greater than 0.25, so an investor should also be cautious in making predictions about future risk level from this kind of information. The significant change in volatility over the decade indicates that an investor with a relatively long investment horizon is assuming an additional risk when he invests in mutual fund shares, the risk that over time the riskiness of his portfolio will change, perhaps to a level not suited to his needs. In sum, not only may systematic risk level be uncertain in the first place, but also an investor has the additional uncertainty of not knowing if and when systematic risk will change.

The significance of the relatively low level of diversification of the funds to the market proxy is hard to assess. Mutual funds were not compared to either simulated randomly selected portfolios or to actual portfolios held by individuals, so it can not be concluded that this level is insufficient for satisfying the economic goals of investors.

It may be that "self-made" portfolios available to individual investors with a much smaller pool of assets to draw upon would be even less diversified. It is also true that the level of diversification of the "portfolios of portfolios" was higher than that of the funds in general, so an individual who desired to improve his level of diversification could purchase shares of more than one fund.

The fact that performance was not linearly related to any fund characteristic over time means that an investor need not spend time or money gathering this information, for it will be of no value in predicting which fund will be the superior performer. The unexpected positive relationship between load funds and performance in 1976-1980 is likely unique to that interval, as was the marginal relationship between performance and RRSP status in the first five years. However, this needs to be verified with information from the succeeding interval, 1981-1985, which for obvious reasons, is as yet unavailable.

In sum, the prospective investor should examine the funds carefully, after deciding what risk level is acceptable to him, and choose the fund with the matching total risk or with the matching estimated β, from among those funds whose estimated β's have remained relatively unchanged, and that offer those financial services most beneficial to him. By choosing a fund with a relatively stable β the investor will likely be reducing the risk of a change in volatility that may be detrimental from his point

of view. By choosing funds with the "right" financial services, an investor can increase his overall return, which includes not only the direct dividends and capital gains but also the indirect gains from reduced costs of, for example, pension planning. Other types of information, such as previous performance and general fund characteristics, while perhaps of general interest will be of little value in predicting whether a fund will do better or worse than other funds. In general, however, returns to the investor should be higher from funds which do not charge a load fee and for which the management expense ratio is comparatively low. Performance was unrelated to the latter, and probably not related to the former over the long term. Since the general level of diversification is relatively low for individual funds, it might be useful to invest in several different funds to reduce risk, provided the load charges are sufficiently low. Otherwise the marginal gain would be offset by the cost of purchase. There is a comforting thought in all these results. If through bad luck or poor decision-making, an investor chose a fund that did worse than average, the chances are that this poor performance would not be repeated in the following interval, since there was generally no consistency in performance over time.

What can be said about the overall behaviour of the mutual fund industry? First and foremost, these results support the efficient markets hypothesis for the segment of the market that invests in stocks generally. The evidence is

less clear for that smaller subpopulation that invests in mutual funds. Secondly, the results also generally support the capital asset pricing model, since returns generally increased with risk in the second time period when the market premium was on average positive, and generally decreased with risk in the first time period when the market premium was on average negative.

The major change in volatility observed reflects the increased holdings of fixed interest securities generally, but is apparently also due to a change in the relationship between the bond and the stock markets in the second five years. These results may thus be somewhat misleading if the second five period were anomalous compared to the average economic state of Canadian capital markets.

The patterns of autocorrelations observed in the fund series are evidence that during the interval of study a significant number of funds held securities of differing trading frequencies. This supports earlier findings that during the interval of study a significant portion of stocks on the Toronto Stock Exchange were moderately to infrequently traded. The fact that the aggregated coefficients method proved useful suggests that the average frequency of trading for the funds and for the market proxy were not the same.

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APPENDIX

Table A-1. Funds included in this study

1. Acrofund
2. AGF Japan Fund
3. AGF Special Fund
4. All-Canadian Compound Fund
5. All-Canadian Dividend Fund
6. All-Canadian Revenue Growth Fund
7. Cundill Value Fund
8. American Growth Fund
9. Associate Investors Fund
10. Bolton-Tremblay International Fund
11. Cambridge Growth Fund
12. Canadian Gas and Energy Fund
13. Canadian Investment Fund
14. Canadian Security Growth Fund
15. Canadian Trusteed Income Fund
16. Canagex Fund
17. Capital Growth Fund
18. Collective Mutual Fund
19. Corporate Investors Mutual Fund
20. Corporate Investors Stock Fund
21. Fonds desJardins Actions
22. Fonds desJardins International
23. Fonds desJardins Obligations
24. Fonds desJardins Speculative
25. Dominion Compound Fund
26. Domequity Fund
27. Eaton/Bay Commonwealth Fund
28. Eaton/Bay Leverage Fund
29. Grouped Investment Compound Fund
30. Grouped Income Shares Fund
31. Goldfund
32. Growth Equity Fund
33. Guardian Growth Fund
34. Guardian North American Fund
35. Harvard Growth Fund
36. Industrial Dividend Fund
37. Industrial Equity Fund
38. Industrial Growth Fund
39. International Energy Fund
40. International Growth Fund
41. Investors Dividend Fund
42. Investors Growth Fund
43. Investors International Fund
44. Investors Mutual Fund
45. Jones Heward Fund
46. Maritime Equity Fund
47. Marlborough Fund
48. Mutual Accumulating Fund
49. Mutual Income Fund
50. Natrusco Common Fund
51. Natural Resources Growth Fund

52. Northwest Canadian Fund
53. Pacific Dividend Fund
54. Pacific US Fund
55. Pension Mutual Fund
56. Phillips, Hager and North Fund
57. Planned Resources Fund
58. Principal Growth Fund
59. Principal Venture Fund
60. Provident Stock Fund
61. Royfund(equity)
62. Savings and Investment American Fund
63. Savings and Investment Mutual Fund
64. Sterling Equity Fund
65. Taurus Fund
66. Templeton Growth Fund
67. TransCanada "B" Fund
68. TransCanada "C" Fund
69. United Accumulative Fund
70. United American Fund
71. United Horizon Fund
72. United Venture Fund
73. Universal Savings Fund
74. Univest Growth Fund
75. Vanguard Growth Fund
76. Western Growth Fund
77. Xanadu Fund
78. Canada Trust Equity Fund
79. Canada Trust Income Fund
80. Fonds desJardins Quebec
81. Fonds desJardins Hypotheque
82. Guaranty Trust Equity Fund
83. Guaranty Trust Income Fund
84. Guaranty Trust RRSP Equity Fund
85. Guaranty Trust RRSP Income Fund
86. Montreal Trust Equity Fund
87. Montreal Trust International Fund
88. Montreal Trust Income Fund
89. Royal Trust "A" Fund
90. Royal Trust "B" Fund
91. Royal Trust "C" Fund
92. Royal Trust "M" Fund
93. Victoria and Grey Income Fund
94. Montreal Trust RRSP Equity Fund
95. Montreal Trust RRSP Income Fund
96. Eaton/Bay Growth Fund
97. Eaton/Bay International Fund
98. Eaton/Bay Venture Fund
99. International Income Fund
100. Investors Japan Fund
101. Prudential Growth Fund
102. Canada Trust RRSP Income Fund
103. Canada Trust RRSP Equity Fund

Table A-2A. Fund data, 1971-1975

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
1	-0.0059	0.0544	0.83	0.94	1.08
2	00.0112	0.0864	0.24*	na	na
3	-0.0026	0.0686	0.85	1.00	0.84
4	-0.0084	0.0423	0.59	0.65	0.58
5	-0.0092	0.0420	0.62	0.68	0.77
6	00.0029	0.0377	0.18	0.27	0.36
7	-0.0087	0.0671	0.82	1.20	1.20
8	-0.0074	0.0515	0.63	0.61	0.62
9	-0.0023	0.0469	0.69	0.83	0.83
10	-0.0046	0.0518	0.80	0.93	1.01
11	-0.0009	0.0496	0.46	0.81	0.44
12	-0.0083	0.0615	0.99	1.01	1.01
13	-0.0027	0.0403	0.70	0.57	0.71
14	-0.0029	0.0543	0.94	1.04	1.04
15	-0.0003	0.0181	0.18	0.15	0.17
16	-0.0046	0.0456	0.76	0.90	0.92
17	-0.0002	0.0499	0.87	0.90	1.02
18	-0.0065	0.0541	0.68	0.87	0.92
19	-0.0029	0.0410	0.72	0.86	0.86
20	-0.0054	0.0512	0.79	0.95	0.99
21	-0.0009	0.0494	0.82	0.88	0.96
22	-0.0091	0.0578	0.68	0.61	0.69
23	-0.0013	0.0281	0.05*	0.14	0.16
24	-0.0188	0.0806	0.98	1.29	0.97
25	00.0014	0.0454	0.72	0.81	0.88
26	00.0008	0.0419	0.51	0.87	0.97
27	-0.0012	0.0383	0.55	0.70	0.82
28	-0.0016	0.0568	0.83	0.81	0.82
29	-0.0056	0.0528	0.61	0.79	0.81
30	-0.0040	0.0482	0.69	0.98	0.91
31	00.0077	0.1108	0.68	0.64	0.68
32	-0.0073	0.0648	1.10	1.15	1.21
33	-0.0048	0.0462	0.68	0.73	0.66
34	-0.0104	0.0684	0.67	0.85	0.65
35	-0.0078	0.0707	1.09	1.42	1.28
36	-0.0044	0.0363	0.38	0.92	0.82
37	00.0030	0.0498	0.61	0.70	0.89
38	00.0114	0.0507	0.50	0.41	0.49
39	-0.0063	0.0523	0.81	0.97	0.97
40	-0.0072	0.0372	0.42	0.53	0.57
41	-0.0026	0.0414	0.69	0.77	0.76
42	-0.0030	0.0447	0.75	0.85	0.90
43	-0.0088	0.0574	0.71	0.90	0.95
44	-0.0034	0.0407	0.61	0.59	0.59
45	-0.0022	0.0539	0.84	1.01	1.02

Table A-2A(cont'd)

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
46	-0.0089	0.0454	0.52	0.83	0.81
47	-0.0061	0.0590	1.00	0.98	1.00
48	-0.0013	0.0414	0.69	0.81	0.86
49	-0.0028	0.0554	0.69	1.03	0.99
50	-0.0024	0.0427	0.74	0.87	0.88
51	-0.0063	0.0494	0.80	0.94	0.97
52	-0.0035	0.0479	0.80	0.94	0.91
53	-0.0036	0.0573	0.88	1.05	1.05
54	-0.0061	0.0743	0.90	0.88	0.78
55	-0.0085	0.0569	0.79	1.02	0.96
56	-0.0032	0.0633	0.88	0.73	0.86
57	-0.0096	0.0732	1.12	1.38	1.43
58	-0.0050	0.0600	0.99	1.24	1.23
59	-0.0025	0.0799	1.22	1.64	1.48
60	-0.0052	0.0500	0.76	0.98	1.01
61	-0.0012	0.0513	0.81	0.94	0.81
62	-0.0078	0.0601	0.68	1.27	1.31
63	-0.0025	0.0467	0.75	0.81	0.92
64	-0.0048	0.0528	0.89	0.78	0.89
65	-0.0104	0.0704	0.98	1.34	1.35
66	00.0072	0.0581	0.53	0.80	0.93
67	00.0021	0.0500	0.73	0.93	1.05
68	00.0002	0.0492	0.74	0.88	0.95
69	-0.0067	0.0514	0.68	0.85	0.68
70	-0.0161	0.0578	0.64	0.95	0.93
71	-0.0133	0.0683	1.02	1.36	1.01
72	-0.0128	0.0732	0.91	0.89	0.90
73	-0.0017	0.0392	0.66	0.84	0.83
74	-0.0041	0.0314	0.35	0.36	0.35
75	-0.0142	0.0755	0.83	1.15	1.10
76	-0.0078	0.0380	0.54	0.80	0.76
77	-0.0055	0.0724	1.10	1.14	1.12
78	-0.0042	0.0866	0.83	0.89	0.96
79	-0.0002	0.0220	0.15	0.21	0.17
80	-0.0058	0.0607	0.94	0.85	0.94
81	-0.0005	0.0119	0.10	0.07	0.10
82	-0.0025	0.0439	0.80	0.79	0.80
83	-0.0009	0.0172	0.05	0.10	0.09
84	-0.0038	0.0462	0.87	0.94	0.93
85	-0.0009	0.0136	0.12	0.16	0.12
86	-0.0019	0.0461	0.87	0.87	0.87
87	-0.0071	0.0499	0.63	0.75	0.63
88	00.0001	0.0177	0.14	0.23	0.21
89	-0.0073	0.0577	0.83	0.82	0.82
90	00.0001	0.0182	0.04*	0.08	na

Table A-2A(cont'd)

Fund	Mean return	Standard deviation	$\hat{\beta}^1$	$\hat{\beta}^2$	$\hat{\beta}^3$
91	-0.0025	0.0478	0.92	0.89	0.92
92	00.0013	0.0099	0.06	0.09	0.06
93	-0.0050	0.1192	0.55	1.26	0.63
94	-0.0028	0.0466	0.72	0.88	0.73
95	00.0010	0.0173	0.11	0.17	0.17
96	-0.0038	0.0539	0.86	0.97	0.86
97	-0.0039	0.0586	0.83	1.03	0.83
98	-0.0076	0.0639	0.98	0.98	0.98
99	-0.0063	0.0188	0.11	0.13	0.11
100	00.0056	0.0518	0.33	0.76	0.61
101	-0.0032	0.0494	0.85	0.94	0.96
102	-0.0009	0.0145	0.12	0.09	0.11
103	-0.0046	0.0470	0.80	0.91	0.80

[1] β estimated from capital asset pricing model with a synchronous market term only; starred values were not significant at the 5 percent level
[2] β estimated from aggregated coefficients, dummy variable model
[3] β estimated from aggregated coefficients, independent regression

Table A-2B. Fund data, 1976-1980

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
1	00.0127	0.0434	0.64	0.85	0.66
2	00.0093	0.0480	0.11*	na	na
3	00.0171	0.0539	0.63	1.00	0.93
4	00.0051	0.0230	0.29	0.34	0.23
5	00.0063	0.0372	0.44	0.33	0.22
6	00.0010	0.0229	0.08*	-0.01	na
7	00.0101	0.0470	0.46	0.39	0.01
8	00.0085	0.0465	0.57	0.61	0.57
9	00.0093	0.0386	0.64	0.66	0.64
10	00.0077	0.0423	0.43	0.46	0.42
11	00.0063	0.0450	0.34	0.63	0.71
12	00.0214	0.0548	0.82	1.01	1.13
13	00.0041	0.0364	0.61	0.57	0.60
14	00.0112	0.0462	0.80	1.04	0.81
15	-0.0020	0.0134	0.05*	-0.18	-0.25
16	00.0075	0.0420	0.71	0.90	0.86
17	00.0064	0.0441	0.68	0.90	0.70
18	00.0099	0.0517	0.64	0.87	0.65
19	00.0045	0.0308	0.36	0.38	0.42
20	00.0169	0.0472	0.66	1.23	0.96
21	00.0076	0.0453	0.66	0.88	0.70
22	00.0048	0.0441	0.52	0.61	0.53
23	-0.0028	0.0333	0.07*	-0.50	-0.50
24	00.0130	0.0724	0.73	1.29	1.10
25	00.0075	0.0406	0.58	0.81	0.74
26	00.0091	0.0263	0.14	0.63	0.39
27	00.0035	0.0283	0.35	0.35	0.21
28	00.0089	0.0376	0.53	0.53	0.53
29	00.0097	0.0454	0.58	0.79	0.58
30	00.0115	0.0469	0.53	0.98	0.53
31	00.0171	0.1151	0.66	0.64	0.59
32	00.0228	0.0554	0.88	0.94	0.86
33	00.0118	0.0438	0.58	0.73	0.57
34	00.0119	0.0413	0.52	0.57	0.52
35	00.0097	0.0644	0.74	1.42	0.75
36	00.0015	0.0532	0.56	0.29	0.59
37	00.0123	0.0419	0.47	0.70	0.18
38	00.0047	0.0460	0.37	0.41	0.28
39	00.0021	0.0354	0.32	0.31	0.21
40	-0.0001	0.0358	0.33	0.53	0.33
41	00.0008	0.0374	0.51	0.66	0.69
42	00.0062	0.0430	0.69	0.85	0.68
43	00.0071	0.0463	0.54	0.61	0.54
44	00.0057	0.0357	0.54	0.59	0.59
45	00.0130	0.0518	0.78	1.01	1.00

Table A-2B(cont'd)

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
46	00.0024	0.0421	0.51	0.50	0.51
47	00.0149	0.0581	0.95	0.98	0.70
48	00.0072	0.0391	0.63	0.81	0.76
49	00.0098	0.0449	0.71	0.69	0.52
50	00.0053	0.0436	0.77	0.87	0.89
51	00.0056	0.0325	0.46	0.47	0.53
52	00.0074	0.0392	0.57	0.77	0.58
53	00.0062	0.0401	0.50	0.49	0.49
54	00.0072	0.0405	0.48	0.50	0.48
55	00.0062	0.0632	0.82	1.02	1.45
56	00.0099	0.0461	0.59	0.73	0.58
57	00.0156	0.0457	0.75	1.10	0.97
58	00.0089	0.0470	0.64	0.69	0.69
59	00.0132	0.0563	0.73	1.30	1.30
60	00.0077	0.0437	0.68	0.98	0.73
61	00.0113	0.0510	0.79	0.94	0.99
62	00.0040	0.0463	0.50	0.55	0.51
63	00.0047	0.0412	0.68	0.81	0.54
64	00.0011	0.0521	0.70	0.78	0.69
65	00.0204	0.0489	0.58	0.58	0.83
66	00.0149	0.0429	0.52	0.33	0.37
67	00.0020	0.0258	0.32	0.19	0.48
68	00.0009	0.0316	0.35	0.53	0.34
69	00.0085	0.0493	0.73	0.85	0.51
70	00.0071	0.0562	0.75	0.63	0.90
71	00.0161	0.0669	0.64	1.36	0.63
72	00.0139	0.0557	0.82	0.89	1.06
73	00.0086	0.0293	0.48	0.68	0.49
74	00.0075	0.0403	0.26	0.36	0.36
75	00.0102	0.0550	0.84	1.15	1.11
76	00.0050	0.0445	0.59	0.80	0.61
77	00.0086	0.0666	0.72	1.43	0.72
78	00.0067	0.0485	0.86	0.85	0.90
79	-0.0024	0.0262	0.16	0.02	-0.42
80	00.0068	0.0439	0.76	0.85	0.75
81	-0.0015	0.0155	0.08	-0.08	-0.19
82	00.0052	0.0505	0.86	0.79	0.79
83	-0.0014	0.0155	0.05*	-0.25	-0.31
84	00.0092	0.0416	0.77	0.75	0.77
85	-0.0024	0.0146	0.04*	-0.29	-0.31
86	00.0070	0.0430	0.69	0.69	0.69
87	00.0053	0.0423	0.56	0.75	0.54
88	-0.0020	0.0204	0.05*	-0.41	-0.41
89	00.0055	0.0419	0.49	0.48	0.49
90	-0.0020	0.0148	0.04*	-0.30	-0.32

Table A-2B(cont'd)

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
91	00.0073	0.0467	0.87	0.89	0.87
92	-0.0009	0.0125	0.10	-0.18	-0.16
93	00.0039	0.0501	0.88	1.26	0.88
94	00.0069	0.0414	0.78	0.76	0.84
95	-0.0024	0.0184	0.04*	-0.37	-0.37
96	00.0088	0.0439	0.45	0.68	0.78
97	00.0114	0.0421	0.48	0.27	0.23
98	00.0112	0.0416	0.53	0.56	0.54
99	00.0006	0.0210	0.13	0.13	0.13
100	00.0062	0.0520	0.09	0.17	-0.30
101	00.0087	0.0424	0.76	0.80	0.77
102	-0.0019	0.0147	0.08*	-0.31	-0.32
103	00.0084	0.0508	0.62	1.16	1.16

[1] β estimated from capital assets pricing model with synchronous market term only; starred values are not significant at the 5 percent level
[2] β estimated from aggregated coefficients, dummy variable model
[3] β estimated from aggregated coefficients, independent regression

Table A-3. Results of regression analysis from dummy variable regressions for fund sample

1. $r=0.0004+0.73m_0+0.23m_1-0.21Dm_1+0.30Dm_{-1}-0.11m_{-2}.$
   (0.16) (13.90) (3.11) (-2.02) (4.02) (-2.06)

2. $r=0.009+0.40Dm_{-1}.$
   (1.51) (2.25)

3. $r=0.003+0.75m_0+0.25m_1.$
   (0.69) (8.85) (2.91)

4. $r=0.01-0.01D+0.31Dm_0+0.25m_0+0.09m_{-1}-1.33m_0^2.$
   (1.57) (-2.35) (3.67) (3.96) (2.11) (-2.99)

5. $r=0.003-0.01+0.50m_0+0.35Dm_{-1}-0.17m_{-1}$
   (0.70) (-2.26) (10.21) (3.63) (-2.45)

6. $r=0.003+0.08m_0+0.14Dm_1+0.14Dm_{-1}-0.09m_{-2}.$
   (0.32) (2.13) (2.50) (2.56) (-2.15)

7. $r=0.006+0.39m_0+0.38Dm_0+0.43Dm_{-1}-2.04m_0^2.$
   (1.15) (3.29) (2.30) (3.75) (-2.37)

8. $r=-0.002+0.61m_0.$
   (-0.72) (8.89)

9. $r=0.001+0.66m_0+0.17Dm_{-1}.$
   (0.43) (14.63) (2.56)

10. $r=-0.001+0.32Dm_0+0.46m_0+0.15m_{-1}$
    (-0.24) (2.26) (5.46) (2.54)

11. $r=-0.002+0.46m_0+0.17m_{-1}+0.18Dm_{-2}.$
    (-0.68) (7.49) (2.81) (2.04)

12. $r=0.006-0.02D+0.92m_0+0.24m_{-1}-0.15m_{-2}+1.80m_0^2.$
    (1.43) (-2.93) (15.70) (4.28) (-2.62) (3.09)

13. $r=0.001+0.64m_0-0.07m_{-2}.$
    (-0.837) (19.71) (-2.08)

14. $r=-0.002+0.89m_0+0.15m_{-1}+1.78Dm_0^2$
    (-1.03) (23.49) (3.84) (2.94)

15. $r=-0.0002+0.15Dm_0+0.18Dm_{-1}-0.13m_{-1}-0.05m_{-2}.$
    (-0.180) (4.38) (3.63) (-3.80) (-2.05)

16. $r=-0.002+0.74m_0+0.16m_{-1}.$
    (-1.319) (20.98) (4.48)

17. $r=-0.001+0.78m_0+0.12m_{-1}.$
    (-0.39) (18.19) (2.90)

18. $r=-0.002+0.67m_0+0.20m_{-1}.$
$(-0.64)\ (9.60)\ (2.89)$

19. $r=-0.0004+0.29Dm_0+0.37m_0+0.12m_1+0.19Dm_{-1}-0.11m_{-2}.$
$(-0.19)\ (4.09)\ (7.43)\ (3.26)\ (3.75)\ (-3.03)$

20. $r=-0.003+0.79m_0-0.28Dm_1+0.24m_1+0.20m_{-1}+1.31m_0^2.$
$(-1.04)\ (14.58)\ (-2.58)\ (3.26)\ (3.77)\ (2.37)$

21. $r=0.002+0.73m_0+0.15m_{-1}-1.10m_0^2.$
$(0.841)\ (15.09)\ (3.18)\ (-2.26)$

22. $r=-0.004+0.61m_0.$
$(-1.26)\ (8.38)$

23. $r=0.002+0.39Dm_{-1}-0.24m_{-1}+0.25Dm_{-2}-0.26m_{-2}-1.71Dm_0^2.$
$(0.670)\ (4.03)\ (-3.45)\ (2.57)\ (-3.86)\ (-2.16)$

24. $r=-0.01+0.90m_0+0.39m_{-1}.$
$(-1.61)\ (8.34)\ (3.60)$

25. $r=0.001+0.64m_0+0.17m_{-1}.$
$(0.577)\ (13.89)\ (3.63)$

26. $r=0.003+0.24Dm_0+0.21m_0+0.12m_1+0.30m_{-1}.$
$(1.09)\ (2.63)\ (3.33)\ (2.68)\ (6.51)$

27. $r=0.002+0.17Dm_0+0.32m_0+0.11m_1+0.18Dm_{-1}-0.08m_{-2}-0.85m_0^2.$
$(0.817)\ (3.07)\ (5.39)\ (2.80)\ (3.07)\ (-2.04)\ (-1.98)$

28. $r=0.004+0.28Dm_0+0.53m_0-1.88Dm_0^2.$
$(1.17)\ (2.44)\ (6.63)\ (-2.07)$

29. $r=-0.001+0.60m_0+0.19m_{-1}.$
$(-0.46)\ (8.97)\ (2.81)$

30. $r=-0.0005+0.62m_0+0.14m_1+0.22m_{-1}.$
$(-0.167)\ (10.35)\ (2.27)\ (3.58)$

31. $r=0.01+0.64m_0.$
$(1.05)\ (3.34)$

32. $r=0.01-0.02D+0.94m_0+0.35Dm_{-1}-0.14m_{-2}.$
$(3.85)\ (-3.60)\ (17.50)\ (4.62)\ (-2.52)$

33. $r=0.003+0.62m_0+0.11m_{-1}-2.08m_0^2.$
$(1.01)\ (11.48)\ (2.03)\ (-2.40)$

34. $r=0.006-0.02D+0.57m_0+0.28Dm_{-1}.$
$(1.04)\ (-2.01)\ (6.88)\ (2.34)$

35. $r=-0.005+93m_0+0.23m_1+0.26m_{-1}.$
$(-1.09)\ (11.25)\ (2.74)\ (3.09)$

36. $r=-0.003+0.47m_0+0.25Dm_{-1}+0.38Dm_{-2}-0.18m_{-2}$.
(-0.79) (7.21) (2.71) (2.88) (-1.99)

37. $r=0.007+0.51m_0+0.33m_{-1}-0.14m_{-2}$.
(2.02) (8.05) (3.73) (-2.26)

38. $r=0.006+0.41m_0$.
(1.58) (5.26)

39. $r=-0.002+0.48Dm_0+0.31m_0+0.18Dm_{-1}$
(-0.73) (4.32) (3.98) (2.26)

40. $r=-0.01+0.38m_0+0.15m_{-1}$.
(-2.13) (6.99) (2.80)

41. $r=-0.004+0.57m_0+0.09m_1+0.25Dm_{-1}-0.14Dm_{-2}$.
(-1.80) (13.96) (2.27) (4.20) (-2.34)

42. $r=-0.002+0.72m_0+0.13m_{-1}$.
(-0.83) (17.72) (3.12)

43. $r=-0.004+0.61m_0+0.29Dm_{-1}$.
(-0.946) (8.57) (2.78)

44. $r=0.0004+0.59m_0-1.93Dm_0^2$.
(0.21) (15.28) (-3.16)

45. $r=0.002+0.77m_0+0.20m_{-1}$.
(0.584) (14.56) (3.47)

46. $r=-0.005+0.50m_0+0.33Dm_{-1}$.
(-1.60) (8.43) (3.87)

47. $r=-0.0005+0.97m_0+0.12m_{-1}-0.11m_{-2}$.
(0.19) (18.60) (2.32) (-2.08)

48. $r=-0.001+0.66m_0+0.15m_{-1}$.
(-0.34) (18.52) (4.32)

49. $r=0.001+0.69m_0+0.34Dm_{-1}$.
(0.281) (11.54) (3.95)

50. $r=-0.002+0.76m_0+0.11m_{-1}$.
(-1.26) (25.10) (3.67)

51. $r=0.001+0.35Dm_0+0.42m_0+0.17m_{-1}-1.15m_0^2$.
(0.494) (4.10) (6.83) (4.10) (-2.55)

52. $r=-0.001+0.17Dm_0+0.60m_0+0.17m_{-1}$.
(-0.59) (4.25) (10.54) (2.11)

53. $r=-0.0003+0.36Dm_0+0.49m_0+0.20Dm_{-1}$
(-0.095) (3.10) (6.13) (2.38)

54. $r=-0.002+0.38Dm_0+0.50m_0.$
(-0.499) (2.28) (4.33)

55. $r=-0.005+0.81m_0+0.21m_{-1}.$
(-1.32) (10.74) (2.80)

56. $r=-0.0004+0.73m_0.$
(-0.099) (10.21)

57. $r=-0.001+0.28Dm_0+0.82m_0+0.28m_{-1}.$
(-0.174) (2.26) (9.47) (4.45)

58. $r=-0.001+0.25Dm_0+0.69m_0+0.30Dm_{-1}.$
(-0.49) (2.34) (9.30) (3.83)

59. $r=-0.0001+0.34Dm_0+0.82m_0+0.21m_1+0.27m_{-1}.$
(-0.024) (2.09) (7.50) (2.62) (3.43)

60. $r=-0.003+0.72m_0+0.26m_{-1}-2.073Dm_0^2+1.18m_0^2.$
(-0.21) (8.71) (2.45) (-2.34) (2.01)

61. $r=0.001+0.79m_0+0.15m_{-1}.$
(0.39) (11.06) (2.12)

62. $r=-0.004+0.55m_0+0.30Dm_1+0.42Dm_{-1}.$
(-0.99) (7.49) (2.82) (3.91)

63. $r=-0.001+0.69m_0+0.21Dm_{-1}-0.09m_{-2}.$
(-0.72) (16.98) (3.65) (-2.27)

64. $r=-0.004+0.78m_0.$
(-1.558) (13.35)

65. $r=0.01-0.02D+0.34Dm_0+0.58m_0+0.42Dm_{-1}.$
(2.57) (-2.83) (2.24) (5.45) (3.86)

66. $r=0.01+0.48m_0+0.47Dm_{-1}-0.15m_{-2}.$
(2.73) (6.54) (4.52) (-2.01)

67. $r=0.002+0.37Dm_0+0.29m_0+0.37Dm_{-1}-0.10m_{-2}.$
(0.749) (4.33) (4.92) (5.99) (-2.20)

68. $r=-0.001+0.35Dm_0+0.36m_0+0.17m_{-1}.$
(-0.518) (3.50) (5.09) (3.45)

69. $r=-0.003+0.72m_0+0.13m_{-1}.$
(-0.880) (11.82) (2.15)

70. $r=0.005-0.02D+0.63m_0+0.32Dm_{-1}-1.60m_0^2.$
(0.80) (-2.02) (7.80) (2.88) (-1.99)

71. $r=-0.005+0.86m_0+0.21m_1+0.29m_{-1}.$
(-0.94) (9.38) (2.28) (3.09)

72. $r=-0.004+0.89m_0$.
(-0.91) (10.56)

73. $r=0.003-0.008D+0.16Dm_0+0.49m_0+0.19Dm_{-1}+1.55Dm_0^2$.
(1.63) (-2.41) (2.77) (12.34) (4.72) (3.20)

74. $r=-0.001+0.36m_0$.
(-0.60) (7.61)

75. $r=-0.006+0.83m_0+0.32m_{-1}$.
(-1.23) (9.45) (2.53)

76. $r=-0.004+0.57m_0+0.23Dm_{-1}$.
(-1.36) (11.27) (3.23)

77. $r=-0.004+0.89m_0+0.22m_1+0.32m_{-1}-0.29Dm_{-2}$.
(-0.97) (10.21) (2.50) (3.60) (-2.24)

78. $r=-0.003+0.92m_0+0.1m_1-0.13Dm_1$.
(-2.10) (29.50)(2.30) (-2.02)

79. $r=-0.001+0.12m_0+0.13m_1+0.19Dm_{-2}-0.23m_{-2}$.
(-0.81) (3.42) (3.53) (2.66) (-4.62)

80. $r=-0.003+0.85m_0$.
(-0.930) (15.97)

81. $r=-0.0005+0.08m_0+0.15Dm_{-2}-0.16m_{-2}$.
(-.45) (3.71) (3.50) (-5.54)

82. $r=-0.0005+0.79m_0$.
(-0.39) (32.32)

83. $r=0.0002+0.12Dm_1+0.23Dm_{-1}-0.15m_{-1}-0.10m_{-2}$.
(0.18) (3.31) (4.28) (-3.90) (-3.73)

84. $r=-0.0002+0.09Dm_0+0.78m_0+0.07Dm_1$.
(-0.152) (2.26) (27.94) (2.32)

85. $r=-0.001+0.11Dm_0+0.06Dm_1+0.17Dm_{-1}-0.17m_{-1}$
$+0.11Dm_{-2}-0.12m_{-2}+0.70Dm_0^2$.
(-1.03) (3.79) (2.01) (4.27) (-5.93) (2.72) (-4.27)
(2.12)

86. $r=0.0002+0.18Dm_0+0.69m_0$.
(0.16) (2.66) (14.43)

87. $r=-0.004+0.60m_0+0.15m_1$.
(-1.17) (9.86) (2.58)

88. $r=0.001+0.11Dm_0+0.11Dm_1+0.27Dm_{-1}-0.23m_{-1}$
$+0.15Dm_{-2}-0.18m_{-2}$.
(0.71) (2.80) (4.88) (2.65) (-5.96) (2.57) (-4.50)

89. $r=-0.002+0.34Dm_0+0.48m_0.$
(-0.68) (2.58) (5.24)

90. $r=0.0003+0.09Dm_1+0.29Dm_{-1}-0.19m_{-1}-0.11m_{-2}.$
(0.20) (2.56) (5.89) (-5.43) (-4.29)

91. $r=-0.001+0.89m_0.$
(-1.24) (50.45)

92. $r=0.0003+0.06m_0+0.10Dm_{-1}-0.10m_{-1}$
$+0.17Dm_{-2}-0.14m_{-2}+0.65Dm_0^2.$
(0.298) (4.07) (3.09) (-3.03) (5.31) (-6.34) (2.54)

93. $r=-0.002+0.69m_0+0.57Dm_1.$
(-0.32) (4.69) (2.74)

94. $r=-0.001+0.76m_0+0.12Dm_{-2}.$
(-0.53) (21.61) (2.37)

95. $r=0.0007+0.10Dm_0+0.09Dm_1+0.22Dm_{-1}-0.20m_{-1}$
$+0.13Dm_{-2}-0.17m_{-2}.$
(0.53) (2.78) (2.50) (4.33) (-5.74) (2.64) (-4.81)

96. $r=-0.002+29Dm_0+0.55m_0+0.13m_{-1}-2.39Dm_0^2+1.98m_0^2.$
(-0.42) (2.37) (6.40) (2.31) (-2.19) (2.69)

97. $r=0.004+0.40Dm_0+0.47m_0+0.36Dm_{-2}-0.20m_{-2}.$
(1.28) (3.09) (5.25) (2.73) (-2.20)

98. $r=-0.008+0.42Dm_0+0.56m_0.$
(0.22) (3.41) (6.52)

99. $r=-0.003+0.13m_0.$
(-1.80) (3.84)

100. $r=0.01+0.26Dm_0+0.17m_1+0.33Dm_{-1}-2.25m_0^2.$
(2.39) (2.12) (2.03) (2.63) (-2.59)

101. $r=0.0001+0.14Dm_0+0.80m_0.$
(0.063) (3.29) (27.58)

102. $r=0.0004+0.11Dm_0+0.20Dm_{-1}-0.17m_{-1}+0.09Dm_{-2}-0.14m_{-2}.$
(0.37) (3.53) (4.54) (-5.81) (2.47) (-4.68)

103. $r=-0.002+0.76m_0-0.21Dm_1+0.22m_1+0.14m_{-2}.$
(-0.84) (13.89) (-1.98) (2.94) (2.55)

Table A-4A. Results of regression analysis from independent regressions, 1971-1975 for fund sample

1. $r=-0.003+0.81m_0+0.27m_1$.
(0.73) (9.34) (3.38)

2. r=no relationship.
(0.00) (0.00)

3. $r=-0.001+0.84m_0$.
(-0.19) (6.06)

4. $r=-0.008+0.58m_0$.
(-2.20) (7.68)

5. $r=-0.009+0.59m_0+0.18m_{-1}$.
(-2.64) (9.10) (2.73)

6. $r=-0.0001+0.11m_0+0.12m_1+0.13m_{-1}$.
(0.040) (2.04) (2.21) (2.29)

7. $r=-0.006+0.77m_0+0.43m_{-1}$.
(-0.94) (6.10) (3.42)

8. $r=-0.007+0.62m_0$.
(-1.34) (5.99)

9. $r=-0.001+0.67m_0+0.16m_{-1}$.
(-0.15) (8.49) (2.07)

10. $r=-0.003+0.77m_0+0.24m_{-1}$
(-0.75) (9.90) (3.10)

11. $r=-0.001+0.44m_0$.
(-0.25) (4.07)

12. $r=-0.001+0.92m_0+0.29m_{-1}-0.20m_{-2}$.
(-1.40) (10.79) (3.50) (-2.29)

13. $r=-0.001+0.71m_0$.
(-0.38) (14.95)

14. $r=-0.006+0.94m_0+0.13m_{-1}+2.25m_0^2$.
(-1.71) (15.41) (2.21) (3.06)

15. $r=-0.0002+0.17m_0$.
(-0.096) (4.27)

16. $r=-0.003+0.73m_0+0.19m_{-1}$.
(-1.07) (13.37) (3.49)

17. $r=0.002+0.85m_0+0.17m_{-1}$.
(0.68) (15.37) (3.11)

18. $r=-0.005+0.64m_0+0.28m_{-1}$.
(-1.01) (6.31) (2.75)

19. $r=-0.001+0.70m_0+0.16m_{-2}$.
(-0.67) (16.23) (3.61)

20. $r=-0.004+0.76m_0+0.23m_{-1}$.
(-1.07) (10.14) (3.00)

21. $r=0.001+0.80m_0+16m_{-1}$.
(0.40) (11.98) (2.41)

22. $r=-0.007+0.69m_0$.
(-1.21) (5.70)

23. $r=0.002+0.16m_{-1}-1.72Dm_0^2$.
(0.57) (2.45) (-2.22)

24. $r=-0.02+0.97m_0$.
(-2.11) (5.91)

25. $r=0.004+0.70m_0+0.18m_{-1}$.
(1.03) (10.56) (2.75)

26. $r=0.003+0.45m_0+0.15m_1+0.37m_{-1}$.
(0.81) (6.23) (2.13) (5.10)

27. $r=-0.0000+0.51m_0+0.13m_1+0.18m_{-1}$.
(-0.03) (7.96) (2.04) (2.68)

28. $r=-0.001+0.82m_0$.
(-0.21) (8.43)

29. $r=-0.005+0.57m_0+0.24m_{-1}$.
(-0.92) (5.37) (2.81)

30. $r=-0.003+0.66m_0+0.25m_{-1}$.
(-0.77) (8.56) (3.02)

31. $r=0.008+0.68m_0$.
(0.58) (2.47)

32. $r=-0.005+1.03m_0+0.34m_{-1}-0.16m_{-2}$.
(-1.26) (14.04) (4.70) (-2.13)

33. $r=0.0005+0.66m_0-1.86m_0^2$.
(0.12) (8.83) (-2.03)

34. $r=-0.01+0.65m_0$.
(-1.48) (4.36)

35. $r=-0.005+1.06m_0+0.22m_{-1}$.
(-0.90) (9.54) (2.01)

36. $r=-0.003+0.38m_0+0.27m_{-1}+0.17m_{-2}$
(-1.03) (5.58) (3.95) (2.54)

37. $r=0.005+0.58m_0+0.31m_{-1}$.
(1.07) (6.20) (3.25)

38. $r=0.01+0.49m_0$.
(2.06) (4.31)

39. $r=-0.004+0.79m_0+0.18m_{-1}$
(-1.00) (9.76) (2.21)

40. $r=-0.006+0.40m_0+0.17m_{-1}$.
(-1.66) (5.17) (2.22)

41. $r=-0.001+0.64m_0+0.23m_{-1}-0.11m_{-2}$.
(-0.46) (12.84) (4.55) (-2.14)

42. $r=-0.001+0.73m_0+0.17m_{-1}$.
(-0.40) (12.84) (2.98)

43. $r=-0.008+0.67m_0+0.28m_{-1}$.
(-1.40) (6.07) (2.50)

44. $r=0.004+0.59m_0-2.30m_0^2$.
(1.00) (9.12) (-2.92)

45. $r=-0.006+0.83m_0+0.21m_{-1}+2.11m_0^2$.
(-1.08) (10.43) (2.59) (2.19)

46. $r=-0.003+0.48m_0+0.33m_{-1}$.
(-1.66) (5.56) (3.80)

47. $r=-0.004+1.00m_0$.
(-1.09) (13.35)

48. $r=-0.00001+0.66m_0+0.20m_{-1}$.
(-0.02) (13.11) (3.91)

49. $r=-0.001+0.65m_0+0.34m_{-1}$.
(-0.14) (15.30) (3.05)

50. $r=-0.0003+0.73m_0+0.15m_{-1}$.
(-0.14) (15.30) (3.05)

51. $r=-0.004+0.77m_0+0.22m_{-1}$.
(-1.51) (11.30) (3.25)

52. $r=-0.003+0.77m_0+0.14m_{-1}$.
(-0.89) (13.54) (2.51)

53. $r=-0.002+0.85m_0+0.20m_{-1}$
(-0.51) (9.75) (2.13)

54. $r=-0.007+0.87m_0$.
$(-0.89)\ (5.98)$

55. $r=-0.006+0.75m_0+0.21m_{-1}$.
$(-1.25)\ (7.56)\ (2.13)$

56. $r=-0.003+0.86m_0$.
$(-0.52)\ (7.63)$

57. $r=-0.006+1.09m_0+0.34m_{-1}$.
$(-0.98)\ (9.75)\ (3.08)$

58. $r=-0.003+0.94m_0+0.29m_{-1}$.
$(-0.84)\ (12.78)\ (3.96)$

59. $r=-0.0003+1.17m_0+0.31m_{-1}$.
$(-0.057)\ (9.45)\ (2.54)$

60. $r=-0.004+0.73m_0+0.28m_{-1}$.
$(-1.05)\ (10.10)\ (3.88)$

61. $r=-0.0001+0.81m_0$.
$(-0.17)\ (10.22)$

62. $r=-0.006+0.60m_0+0.29m_1+0.42m_{-1}$.
$(-0.94)\ (5.16)\ (3.55)\ (2.55)$

63. $r=-0.001+0.72m_0+0.20m_{-1}$.
$(-0.31)\ (11.13)\ (3.03)$

64. $r=-0.003+0.89m_0$.
$(-0.76)\ (12.54)$

65. $r=-0.008+0.93m_0+0.42m_{-1}$.
$(-1.32)\ (7.85)\ (3.57)$

66. $r=0.009+0.48m_0+0.45m_{-1}$.
$(1.46)\ (3.93)\ (3.77)$

67. $r=0.004+0.69m_0+0.36m_{-1}$.
$(1.02)\ (9.58)\ (4.96)$

68. $r=0.002+0.71m_0+0.24m_{-1}$.
$(0.45)\ (9.18)\ (3.05)$

69. $r=-0.006+0.68m_0$.
$(-1.10)\ (6.89)$

70. $r=-0.015+0.60m_0+0.33m_{-1}$.
$(-2.60)\ (5.11)\ (2.80)$

71. $r=-0.012+1.01m_0$.
$(-2.15)\ (9.01)$

72. $r=-0.012+0.90m_0.$
(-1.60) (16.15)

73. $r=-0.004+0.64m_0+0.19m_{-1}+1.56m_0^2.$
(-1.71) (15.39) (4.54) (3.08)

74. $r=-0.003+0.35m_0.$
(-0.95) (5.16)

75. $r=-0.01+0.78m_0+0.32m_1.$
(-1.64) (4.95) (2.01)

76. $r=-0.006+0.52m_0+0.24m_{-1}.$
(-1.88) (8.45) (3.89)

77. $r=-0.003+1.01m_0+0.34m_{-1}-0.23m_{-2}.$
(-0.57) (8.94) (3.02) (-2.06)

78. $r=-0.002+0.96m_0.$
(-0.23) (21.14)

79. $r=-0.0004+0.17m_0+0.13m_1.$
(-0.01) (2.10) (2.75)

80. $r=-0.003+0.94m_0.$
(-0.68) (9.75)

81. $r=-0.0001+0.10m_0.$
(-0.20) (3.71)

82. $r=-0.0006+0.80m_0.$
(-0.31) (19.90)

83. $r=-0.0006+0.09m_1.$
(-0.30) (2.24)

84. $r=-0.001+0.87m_0+0.06m_1.$
(-0.92) (28.76) (2.17)

85. $r=-0.003+0.12m_0+0.93m_0^2.$
(-1.92) (4.03) (2.55)

86. $r=-0.0004+0.87m_0.$
(-0.23) (26.11)

87. $r=-0.006+0.63m_0.$
(-1.21) (6.23)

88. $r=-0.0002+0.12m_0+0.09m_1.$
(-0.11) (3.12) (2.68)

89. $r=-0.006+0.82m_0.$
(-1.15) (8.00)

90. $r=$ no relationship.
(0.00)

91. $r=-0.0003+0.92m_0$.
$(-0.25)\ (37.86)$

92. $r=-0.0005+0.06m_0+0.66m_0^2$.
$(-0.41)\ (2.73)\ (2.32)$

93. $r=-0.004+0.63m_0$.
$(-0.25)\ (2.13)$

94. $r=-0.002+0.73m_0$.
$(-0.47)\ (10.27)$

95. $r=0.0003+0.11m_0+0.08m_1$.
$(0.20)\ (3.20)\ (2.40)$

96. $r=-0.0007+0.86m_0$.
$(-0.17)\ (11.54)$

97. $r=-0.0008+0.83m_0$.
$(-0.16)\ (8.41)$

98. $r=-0.002+0.98m_0$.
$(-0.80)\ (10.15)$

99. $r=-0.0006+0.11m_0$.
$(-2.40)\ (2.48)$

100. $r=0.007+0.30m_0+0.31m_{-1}$.
$(1.18)\ (2.45)\ (2.53)$

101. $r=0.0001+0.83m_0+0.13m_{-1}$.
$(0.059)\ (2.79)\ (17.31)$

102. $r=-0.0004+0.11m_0$.
$(-0.26)\ (3.46)$

103. $r=-0.002+0.80m_0$.
$(-0.64)\ (15.92)$

Table A-4B. Results of regression analysis from independent regressions, 1976-1980 for fund sample

1. $r=0.004+0.64m_0+0.20m_1-0.18m_{-2}$.
(1.84) (10.11) (3.18) (-2.86)

2. r=no relationship.
(0.00)

3. $r=0.008+0.67m_0+0.26m_1$.
(1.40) (6.30) (2.47)

4. $r=0.006+0.23m_0-1.31m_0^2$.
(2.55) (5.25) (-3.33)

5. $r=0.004+0.41m_0-0.19m_{-1}$.
(0.96) (5.72) (-2.53)

6. r=no relationship.
(0.00)

7. $r=0.016+0.31m_0-0.30m_{-2}-1.86m_0^2$.
(2.70) (3.06) (-3.13) (-2.02)

8. $r=0.002+0.57m_0$.
(0.50) (6.29)

9. $r=0.003+0.64m_0$.
(1.10) (13.33)

10. $r=0.004+0.42m_0$.
(0.73) (4.60)

11. $r=-0.005+0.49m_0+0.22m_{-1}$.
(-1.25) (6.94) (3.10)

12. $r=0.006+0.92m_0+0.21m_{-1}+1.64m_0^2$.
(1.14) (10.41) (2.57) (2.11)

13. $r=-0.002+0.60m_0$.
(-0.76) (13.32)

14. $r=0.003+0.80m_0+0.11m_{-1}-0.10m_{-2}$.
(1.22) (17.49) (2.41) (-2.10)

15. $r=0.0003-0.14m_{-1}-0.10m_{-2}$.
(0.27) (-4.91) (-3.50)

16. $r=-0.001+0.74m_0+0.12m_{-1}$.
(-0.56) (15.43) (2.59)

17. $r=-0.001+0.70m_0$.
(-0.33) (10.65)

18. $r=0.003+0.65m_0.$
$(-0.55)\ (5.46)$

19. $r=-0.0001+0.37m_0+0.17m_1-0.12m_{-2}.$
$(-0.15)\ (6.30)\ (2.19)\ (-2.09)$

20. $r=0.002+0.78m_0+0.18m_1+1.79m_0{}^2.$
$(0.50)\ (9.20)\ (2.36)\ (2.42)$

21. $r=-0.0001+0.70m_0.$
$(-0.18)\ (9.91)$

22. $r=-0.001+0.53m_0.$
$(-0.22)\ (6.04)$

23. $r=0.002-0.24m_{-1}-0.26m_{-2}.$
$(0.40)\ (-3.18)\ (-3.55)$

24. $r=0.011+0.66m_0+0.44m_{-1}-3.59m_0{}^2.$
$(1.26)\ (4.23)\ (3.08)\ (-2.62)$

25. $r=0.0003+0.59m_0+0.15m_{-1}.$
$(0.073)\ (8.75)\ (2.22)$

26. $r=0.005+0.18m_0+0.21m_{-1}.$
$(1.54)\ (3.00)\ (3.56)$

27. $r=0.001+0.34m_0-0.13m_{-2}.$
$(0.40)\ (6.28)\ (-2.46)$

28. $r=0.004+0.53m_0.$
$(1.05)\ (8.16)$

29. $r=0.003+0.58m_0.$
$(0.85)\ (6.62)$

30. $r=0.006+0.53m_0.$
$(1.22)\ (5.42)$

31. $r=0.014+0.59m_0.$
$(0.92)\ (2.13)$

32. $r=0.014+0.86m_0.$
$(3.54)\ (11.40)$

33. $r=0.007+0.57m_0.$
$(1.53)\ (7.00)$

34. $r=0.007+0.52m_0.$
$(1.64)\ (6.52)$

35. $r=0.002+75m_0.$
$(0.30)\ (5.67)$

36. $r=-0.005+0.59m_0$
$(-0.93)\ (5.30)$

37. $r=0.010+0.43m_0-0.25m_{-2}$.
$(2.36)\ (5.20)\ (-3.00)$

38. $r=0.009+0.28m_0-2.22m_0^2$.
$(1.40)\ (2.17)\ (-2.20)$

39. $r=0.006+0.21m_0-1.90m_0^2$.
$(1.40)\ (2.55)\ (-2.62)$

40. $r=-0.003+0.33m_0$.
$(-0.79)\ (4.09)$

41. $r=-0.007+0.55m_0+0.14m_1$.
$(-1.90)\ (8.37)\ (2.21)$

42. $r=-0.0006+0.68m_0$.
$(-0.18)\ (11.32)$

43. $r=0.002+0.54m_0$.
$(0.36)\ (5.71)$

44. $r=-0.002+0.59m_0$.
$(-0.92)\ (13.86)$

45. $r=0.003+0.80m_0+0.20m_{-1}$.
$(0.74)\ (10.13)\ (2.48)$

46. $r=-0.003+0.51m_0$.
$(-0.61)\ (6.03)$

47. $r=0.008+0.91m_0-0.21m_{-2}$.
$(2.11)\ (12.50)\ (-2.93)$

48. $r=-0.0007+0.65m_0+0.11m_{-1}$.
$(-0.25)\ (12.29)\ (2.15)$

49. $r=0.004+0.69m_0-0.17m_{-1}$.
$(1.36)\ (11.09)\ (-2.69)$

50. $r=-0.004+0.79m_0+0.10m_{-1}$.
$(-1.82)\ (20.13)\ (2.39)$

51. $r=0.004+0.40m_0+0.13m_{-1}-1.19m_0^2$.
$(1.40)\ (7.30)\ (2.51)\ (-2.46)$

52. $r=0.002+0.58m_0$
$(0.58)\ (5.95)$

53. $r=0.002+0.49m_0$.
$(0.44)\ (6.30)$

54. $r=0.002+0.48m_0.$
(0.58) (5.95)

55. $r=-0.008+0.91m_0+0.26m_1+0.28m_{-1}.$
(-1.31) (7.76) (2.28) (2.40)

56. $r=0.004+0.58m_0.$
(0.93) (6.65)

57. $r=0.006+0.78m_0+0.19m_{-1}.$
(1.98) (14.27) (3.37)

58. $r=-0.0004+0.69m_0.$
(-0.11) (8.73)

59. $r=-0.0001+0.82m_0+0.21m_1+0.27m_{-1}.$
(-0.023) (8.04) (2.65) (2.03)

60. $r=-0.003+0.73m_0+1.26m_0^2.$
(-0.85) (10.70) (2.04)

61. $r=0.001+0.82m_0+0.17m_{-1}.$
(0.29) (11.21) (2.32)

62. $r=-0.001+0.51m_0.$
(-0.28) (5.20)

63. $r=-0.0009+0.67m_0-0.13m_{-2}.$
(-0.37) (13.32) (-2.64)

64. $r=-0.005+0.69m_0.$
(-1.08) (7.35)

65. $r=0.012+0.62m_0+0.21m_1.$
(2.40) (6.47) (2.27)

66. $r=0.012+0.48m_0-0.21m_{-2}.$
(2.80) (5.83) (-2.59)

67. $r=-0.003+0.34m_0+0.14m_{-1}.$
(-1.17) (7.13) (2.87)

68. $r=-0.002+0.34m_0.$
(-0.69) (5.14)

69. $r=0.003+0.71m_0-0.20m_{-2}.$
(0.77) (9.30) (-2.63)

70. $r=0.004+0.69m_0+0.23m_1-2.16m_0^2.$
(0.63) (2.34) (6.45) (-2.29)

71. $r=0.010+0.63m_0.$
(1.26) (4.24)

72. $r=0.003+0.88m_0+0.18m_1.$
(0.55) (10.09) (2.09)

73. $r=0.003+0.49m_0.$
(1.70) (12.83)

74. $r=0.0003+0.36m_0.$
(0.09) (5.30)

75. $r=-0.013+0.79m_0+0.32m_{-1}.$
(-1.64) (4.95) (2.01)

76. $r=-0.002+0.61m_0.$
(-0.45) (7.50)

77. $r=0.001+0.72m_0.$
(0.18) (5.10)

78. $r=0.003+0.89m_0+0.01m_1.$
(-1.47) (20.75) (2.24)

79. $r=0.002-0.14m_{-1}-0.28m_{-2}.$
(0.70) (-2.50) (-4.88)

80. $r=-0.0003+0.75m_0.$
(-0.15) (16.20)

81. $r=-0.0003-0.19m_{-2}.$
(-0.19) (-5.55)

82. $r=-0.0003+0.79m_0.$
(-0.17) (26.26)

83. $r=0.002-0.16m_{-1}-0.15m_{-2}.$
(1.10) (-5.14) (-4.82)

84. $r=0.001+0.77m_0.$
(0.81) (29.17)

85. $r=0.0005-0.18m_{-1}-0.13m_{-2}.$
(0.38) (-6.50) (-4.76)

86. $r=-0.0002+0.69m_0.$
(-0.05) (11.50)

87. $r=0.0005+0.54m_0.$
(0.12) (7.11)

88. $r=0.002-0.23m_{-1}-0.18m_{-2}.$
(0.92) (-6.06) (-4.63)

89. $r=0.001+0.49m_0.$
(0.32) (5.55)

90. $r=0.001-0.19m_{-1}-0.13m_{-2}$.
$(0.86)\ (-7.57)\ (-5.19)$

91. $r=-0.002+0.87m_0$.
$(-1.24)\ (33.34)$

92. $r=0.001+0.06m_0-0.07m_{-1}-0.15m_{-2}$.
$(0.90)\ (2.70)\ (-3.22)\ (-6.62)$

93. $r=-0.005+0.88m_0$.
$(-1.94)\ (18.14)$

94. $r=-0.002+0.80m_0+0.04m_1+0.36m_0^2$.
$(-2.16)\ (10.91)\ (2.06)\ (2.06)$

95. $r=0.001-0.20m_{-1}-0.17m_{-2}$.
$(0.20)\ (3.21)\ (2.40)$

96. $r=-0.005+0.58m_0+0.20m_{-1}+2.21m_0^2$.
$(-0.93)\ (5.94)\ (2.19)\ (2.57)$

97. $r=0.009+0.45m_0-0.22m_{-2}$.
$(1.98)\ (5.36)\ (-2.61)$

98. $r=+0.005+0.54m_0$.
$(1.26)\ (6.87)$

99. $r=-0.007+0.13m_0$.
$(-0.264)\ (2.58)$

100. $r=0.009-0.30m_{-2}$.
$(1.33)\ (-2.31)$

101. $r=0.0005+0.77m_0$.
$(0.27)\ (21.90)$

102. $r=0.001-0.18m_{-1}-0.14m_{-2}$.
$(1.02)\ (-6.67)\ (-5.49)$

103. $r=-0.004+0.72m_0+0.22m_1+0.22m_{-2}$.
$(-0.38)\ (7.49)\ (2.31)\ (2.42)$

Table A-5A. Regression statistics from dummy variable regressions for fund sample

Fund	R^2	DW value*	Q-value
1	0.69	2.04	05.50
2	0.04	2.37	05.46
3	0.43	2.10	01.09
4	0.58	2.29	07.06
5	0.56	2.29	07.62
6	0.16	2.23	06.38
7	0.45	2.41	13.22
8	0.41	1.95	03.05
9	0.67	2.65	32.66
10	0.54	2.03	05.73
11	0.36	2.25	02.11
12	0.75	2.19	02.80
13	0.79	2.49	11.97
14	0.83	1.81	03.46
15	0.27	1.93	07.11
16	0.81	2.37	06.71
17	0.75	2.47	14.63
18	0.46	2.19	03.59
19	0.72	2.06	16.48
20	0.68	2.29	08.53
21	0.71	3.07	50.63
22	0.38	2.11	01.40
23	0.22	2.57	13.63
24	0.42	2.01	04.05
25	0.64	2.54	10.08
26	0.50	2.30	11.06
27	0.58	1.93	07.27
28	0.59	2.13	06.79
29	0.44	2.29	04.06
30	0.52	2.16	01.62
31	0.09	1.85	05.88
32	0.79	2.49	21.14
33	0.57	2.21	07.32
34	0.37	2.29	03.49
35	0.55	2.22	03.55
36	0.40	2.07	05.67
37	0.46	2.12	05.11
38	0.19	1.98	10.17
39	0.52	2.76	25.34
40	0.35	2.31	06.23
41	0.68	2.32	08.53
42	0.74	2.64	16.89
43	0.43	2.03	06.40
44	0.69	2.59	04.14
45	0.67	2.86	23.78

Table A-5A(cont'd)

Fund	R^2	DW value*	Q-value
46	0.46	2.52	10.84
47	0.78	2.14	08.55
48	0.76	2.41	13.09
49	0.58	2.35	23.42
50	0.85	2.16	07.75
51	0.71	2.22	09.74
52	0.73	2.42	13.63
53	0.58	2.21	14.65
54	0.39	1.94	03.35
55	0.52	2.34	07.10
56	0.48	1.88	05.12
57	0.70	2.68	17.50
58	0.70	2.21	02.94
59	0.62	1.91	00.00
60	0.70	2.77	04.34
61	0.53	3.08	41.10
62	0.43	2.32	08.89
63	0.75	2.54	14.53
64	0.61	2.17	04.79
65	0.56	1.67	08.57
66	0.41	1.89	00.78
67	0.65	2.40	07.46
68	0.55	2.37	07.78
69	0.56	2.81	25.64
70	0.47	2.01	06.94
71	0.47	2.29	08.00
72	0.49	2.43	10.81
73	0.81	2.30	07.15
74	0.34	2.19	04.25
75	0.47	2.28	07.96
76	0.56	2.33	04.61
77	0.54	2.15	05.64
78	0.89	2.86	26.62
79	0.31	2.29	na
80	0.70	2.54	15.91
81	0.31	2.48	35.34
82	0.90	1.96	02.80
83	0.24	2.01	06.82
84	0.94	1.62	12.72
85	0.41	1.35	22.99
86	0.82	2.88	28.05
87	0.47	1.76	01.38
88	0.38	1.83	12.12
89	0.48	2.02	08.91
90	0.32	2.06	13.16

Table A-5A(cont'd)

Fund	R^2	DW value*	Q-value
91	0.96	2.49	12.89
92	0.43	2.13	02.59
93	0.22	1.85	01.67
94	0.80	2.07	24.07
95	0.38	2.04	11.08
96	0.60	2.44	12.68
97	0.54	1.91	08.20
98	0.60	1.89	07.76
99	0.13	2.16	02.88
100	0.18	1.61	07.99
101	0.88	2.05	05.34
102	0.38	1.60	14.04
103	0.65	2.95	32.05

*Durbin-Watson statistic

Table A-5B. Regression statistics from independent regressions, 1971-1975 for fund sample

Fund	R^2	DW value*	Q-value
1	0.68	2.36	05.05
2	na	na	na
3	0.42	1.98	00.72
4	0.51	2.28	03.66
5	0.64	2.31	05.37
6	0.22	1.78	04.92
7	0.50	2.62	11.40
8	0.39	1.82	03.09
9	0.60	2.78	16.75
10	0.68	2.25	03.96
11	0.23	2.27	05.04
12	0.75	2.51	05.34
13	0.79	2.73	09.80
14	0.83	1.95	06.93
15	0.25	2.21	08.31
16	0.79	2.45	07.00
17	0.83	2.81	13.66
18	0.48	2.15	05.78
19	0.84	2.67	19.02
20	0.69	2.61	12.57
21	0.74	2.96	24.33
22	0.37	2.17	03.11
23	0.17	2.37	08.17
24	0.38	1.93	01.30
25	0.70	3.04	20.95
26	0.59	2.39	15.25
27	0.61	2.00	08.80
28	0.56	2.24	07.28
29	0.40	2.36	04.06
30	0.62	1.71	06.13
31	0.10	1.84	07.77
32	0.83	2.50	09.47
33	0.61	1.91	01.63
34	0.25	2.27	02.12
35	0.65	2.38	04.20
36	0.52	2.30	05.52
37	0.50	1.95	01.10
38	0.25	1.58	17.16
39	0.66	2.60	14.32
40	0.39	2.50	07.95
41	0.81	2.41	07.72
42	0.77	2.77	14.65
43	0.46	1.77	06.70
44	0.64	2.63	08.15
45	0.70	2.72	12.35

Table A-5B(cont'd)

Fund	R^2	DW value*	Q-value
46	0.48	2.36	05.38
47	0.77	2.30	08.40
48	0.79	2.56	21.16
49	0.50	2.42	19.17
50	0.82	2.43	05.57
51	0.73	2.50	11.69
52	0.78	1.98	08.85
53	0.66	2.43	09.63
54	0.40	1.98	02.92
55	0.55	2.59	08.27
56	0.44	1.88	05.70
57	0.67	2.80	12.50
58	0.78	2.19	03.25
59	0.65	2.24	03.18
60	0.70	2.20	06.32
61	0.65	3.04	26.05
62	0.56	2.26	06.05
63	0.72	2.70	16.12
64	0.74	2.53	07.25
65	0.60	1.42	06.84
66	0.37	1.90	00.94
67	0.70	2.64	09.18
68	0.65	2.46	09.62
69	0.46	2.93	18.57
70	0.41	1.78	02.74
71	0.59	1.60	07.86
72	0.40	2.41	06.40
73	0.84	2.21	05.42
74	0.32	2.57	09.89
75	0.36	2.36	04.87
76	0.63	2.70	11.58
77	0.68	2.31	04.04
78	0.89	2.64	13.73
79	0.23	2.06	na
80	0.63	2.57	14.37
81	0.20	2.70	11.85
82	0.88	1.77	09.31
83	0.08	2.12	07.23
84	0.94	1.41	10.42
85	0.28	1.30	13.18
86	0.92	2.11	09.50
87	0.41	1.64	05.33
88	0.23	2.01	10.74
89	0.53	1.92	05.56
90	na	na	na

Table A-5B(cont'd)

Fund	R^2	DW value*	Q-value
91	0.96	2.30	18.35
92	0.18	2.34	04.47
93	0.08	1.78	01.55
94	0.65	2.00	15.52
95	0.24	2.33	10.22
96	0.72	2.32	04.05
97	0.58	2.03	08.57
98	0.67	2.24	06.50
99	0.11	2.47	05.80
100	0.21	1.76	na
101	0.83	1.83	04.65
102	0.18	1.73	06.95
103	0.80	2.38	12.13

*Durbin-Watson statistic

Table A-5C. Regression statistics from independent regressions 1976-1980 for fund sample

Fund	R^2	DW value*	Q-value
1	0.70	1.78	05.44
2	0.05	na	na
3	0.43	2.07	06.88
4	0.54	2.14	10.59
5	0.45	2.38	04.10
6	na	na	na
7	0.43	1.87	09.66
8	0.41	2.07	02.24
9	0.76	2.24	09.34
10	0.27	1.80	06.74
11	0.48	2.05	06.00
12	0.68	1.88	05.52
13	0.79	2.46	09.83
14	0.86	1.60	05.40
15	0.36	1.31	18.59
16	0.80	2.28	06.78
17	0.67	2.26	03.36
18	0.42	2.30	06.66
19	0.50	1.80	07.91
20	0.62	2.07	02.44
21	0.63	3.15	25.72
22	0.39	1.93	03.47
23	0.26	2.62	14.58
24	0.45	1.94	02.14
25	0.58	2.19	06.73
26	0.25	1.95	04.04
27	0.49	1.94	03.46
28	0.54	1.99	01.94
29	0.43	2.24	08.32
30	0.34	2.55	09.57
31	0.07	1.66	09.03
32	0.70	2.41	17.57
33	0.46	2.41	17.39
34	0.43	2.16	03.19
35	0.36	2.18	05.92
36	0.33	2.03	02.24
37	0.44	2.31	08.36
38	0.25	1.58	08.38
39	0.28	2.87	18.67
40	0.23	2.15	05.73
41	0.56	2.25	06.40
42	0.70	2.49	07.67
43	0.36	2.35	06.85
44	0.77	2.37	09.02
45	0.65	2.82	12.13

Table A-5C(cont'd)

Fund	R^2	DW value*	Q-value
46	0.39	2.70	10.52
47	0.77	2.14	06.97
48	0.73	2.24	03.14
49	0.73	2.41	01.84
50	0.88	1.79	03.66
51	0.62	1.80	02.68
52	0.65	2.75	19.28
53	0.41	1.96	06.48
54	0.38	1.72	05.87
55	0.53	2.04	05.78
56	0.51	1.83	05.40
57	0.79	2.43	05.68
58	0.57	2.24	05.52
59	0.21	1.41	13.76
60	0.68	2.37	04.26
61	0.82	3.16	34.60
62	0.32	2.17	04.64
63	0.79	2.20	04.00
64	0.49	2.08	02.15
65	0.44	1.78	03.18
66	0.46	1.99	04.40
67	0.49	1.97	02.82
68	0.32	2.19	01.88
69	0.66	2.43	06.22
70	0.57	2.37	na
71	0.24	2.72	11.04
72	0.65	2.72	12.88
73	0.74	2.39	09.91
74	0.33	1.80	04.06
75	0.64	2.17	02.31
76	0.50	2.11	02.83
77	0.31	2.11	06.45
78	0.89	2.99	20.03
79	0.32	2.17	14.35
80	0.82	2.49	05.35
81	0.35	2.30	26.34
82	0.92	2.34	07.61
83	0.45	1.68	03.30
84	0.94	1.86	10.82
85	0.50	1.40	21.27
86	0.70	3.06	na
87	0.47	1.93	04.08
88	0.49	1.63	10.03
89	0.35	2.12	04.28
90	0.57	1.02	33.20

Table A-5C(cont'd)

Fund	R^2	DW value*	Q-value
91	0.95	2.74	14.64
92	0.58	1.82	01.15
93	0.85	2.82	17.08
94	0.97	2.02	05.49
95	0.45	1.78	09.94
96	0.41	2.51	08.33
97	0.43	1.69	07.22
98	0.45	1.43	07.94
99	0.10	1.97	04.55
100	0.09	1.57	06.22
101	0.89	1.79	03.90
102	0.59	1.52	22.83
103	0.51	3.03	20.44

*Durbin-Watson statistic

Table A-6. Estimated autocorrelations for fund series, for 1971-1980

Fund	$\hat{\rho}_1$	$\hat{\rho}_2$	$\hat{\rho}_3$	$\hat{\rho}_4$	$\hat{\rho}_5$	$\hat{\rho}_6$	SE
m_0	-0.024	-0.167	0.088	-0.097	00.125	00.078	0.087
rf	00.894	00.841	00.773	00.736	00.691	00.667	0.087
1	00.151	-0.233	00.069	00.153	00.027	00.001	0.087
2	-0.141	00.097	00.083	00.001	00.036	-0.115	0.087
3	00.154	-0.013	00.026	00.042	-0.007	-0.047	0.087
4	00.160	-0.025	00.184	00.098	00.055	00.009	0.087
5	00.034	-0.028	00.189	00.016	00.066	00.006	0.087
6	-0.000	00.046	00.096	-0.066	00.084	00.052	0.087
7	00.086	-0.010	00.019	-0.003	00.100	00.183	0.087
8	00.105	-0.005	00.075	00.070	00.114	-0.123	0.087
9	-0.048	-0.223	00.133	-0.131	00.075	00.140	0.087
10	00.155	-0.117	00.054	00.043	-0.005	-0.193	0.087
11	-0.052	-0.030	-0.130	00.031	00.112	00.002	0.087
12	00.074	-0.200	00.137	00.080	00.021	00.112	0.087
13	-0.000	-0.391	00.163	00.086	00.041	-0.029	0.087
14	00.130	-0.288	00.013	-0.009	00.008	00.020	0.087
15	00.113	-0.020	00.274	00.118	00.008	00.020	0.087
16	00.122	-0.208	00.014	00.041	00.143	-0.023	0.087
17	00.058	-0.296	00.112	-0.011	00.001	00.023	0.087
18	00.117	-0.083	-0.069	00.031	00.003	-0.012	0.087
19	00.159	-0.312	00.024	00.168	-0.029	-0.072	0.087
20	00.102	-0.110	00.109	00.098	00.031	00.041	0.087
21	-0.068	-0.136	00.028	-0.025	00.047	00.070	0.087
22	00.046	-0.091	00.004	00.031	-0.032	-0.059	0.087
23	-0.190	00.023	00.041	-0.056	00.019	-0.036	0.087
24	00.173	-0.095	00.063	00.065	-0.039	-0.081	0.087
25	00.036	-0.222	00.040	00.014	00.040	00.034	0.087
26	00.208	-0.112	00.051	00.145	00.066	00.076	0.087
27	00.206	-0.072	00.046	-0.006	00.026	-0.118	0.087
28	00.087	00.027	00.042	-0.034	00.057	-0.147	0.087
29	00.076	-0.051	00.021	00.032	00.087	00.036	0.087
30	00.147	-0.067	00.002	-0.086	00.058	00.116	0.087
31	00.106	-0.033	-0.093	00.086	-0.003	-0.118	0.087
32	00.093	-0.143	00.056	00.102	00.132	00.067	0.087
33	00.105	-0.030	-0.019	00.017	00.114	00.026	0.087
34	00.030	-0.021	00.051	00.007	00.042	00.010	0.087
35	00.134	-0.154	-0.006	00.016	00.014	00.031	0.087
36	00.099	-0.003	00.055	-0.019	00.072	-0.068	0.087
37	00.088	-0.146	-0.143	-0.027	-0.060	-0.033	0.087
38	00.022	00.011	-0.024	-0.062	-0.199	-0.076	0.087
39	-0.058	-0.152	00.117	00.123	-0.128	00.037	0.087
40	00.014	-0.179	00.013	-0.108	-0.056	00.073	0.087
41	00.077	-0.271	00.033	00.057	00.113	00.034	0.087
42	00.051	-0.245	00.019	00.063	00.148	00.032	0.087
43	00.119	-0.074	00.016	00.076	00.002	-0.134	0.088
44	-0.004	-0.176	-0.009	-0.016	00.219	-0.035	0.087
45	-0.002	-0.137	-0.013	00.051	-0.007	00.091	0.087

Table A-6(cont'd)

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
46	-0.002	-0.106	-0.013	00.010	00.169	00.043	0.087
47	00.053	-0.256	00.077	00.040	00.025	00.034	0.087
48	00.053	-0.230	00.051	-0.052	00.098	00.058	0.087
49	00.029	-0.320	00.039	00.014	00.098	-0.063	0.087
50	00.095	-0.186	00:060	00.043	00.121	00.007	0.087
51	00.153	-0.177	00.005	-0.001	00.040	00.047	0.087
52	00.092	-0.092	00.007	00.078	00.035	-0.068	0.087
53	00.074	-0.136	00.027	00.075	-0.099	-0.026	0.087
54	00.134	-0.154	00.017	00.018	00.031	-0.140	0.087
55	00.074	-0.189	-0.041	00.015	-0.004	00.015	0.087
56	00.123	-0.024	-0.024	00.019	00.051	-0.113	0.087
57	00.100	-0.177	00.167	00.072	-0.072	00.032	0.087
58	00.127	-0.230	00.085	00.079	-0.005	-0.090	0.087
59	00.214	-0.226	-0.084	00.069	00.007	-0.010	0.087
60	00.124	-0.128	00.085	00.022	00.129	-0.015	0.087
61	-0.081	-0.134	00.020	-0.014	00.145	00.071	0.087
62	00.105	-0.090	00.017	00.079	00.123	-0.129	0.087
63	00.063	-0.294	00.031	00.002	00.098	00.016	0.087
64	-0.007	-0.164	00.094	-0.045	00.016	-0.076	0.087
65	00.340	00.047	00.057	-0.010	-0.064	-0.169	0.087
66	00.149	-0.051	-0.007	-0.024	00.080	-0.009	0.087
67	00.135	-0.173	00.026	00.112	-0.018	-0.024	0.087
68	00.087	-0.078	00.042	-0.008	-0.049	-0.036	0.087
69	-0.094	-0.041	00.0	00.103	00.178	-0.009	0.087
70	00.137	-0.089	00.010	-0.009	00.155	-0.083	0.087
71	00.104	-0.013	00.032	00.042	00.127	00.037	0.087
72	00.012	00.002	00.060	-0.050	00.108	00.065	0.087
73	00.108	-0.230	00.079	00.022	00.050	00.019	0.087
74	00.095	00.0	00.100	-0.084	00.112	00.112	0.087
75	00.003	00.019	00.047	-0.026	00.093	-0.044	0.087
76	-0.039	-0.077	00.118	-0.027	00.042	00.041	0.087
77	00.120	-0.243	-0.068	00.012	00.064	00.047	0.087
78	-0.038	-0.137	-0.007	-0.086	00.168	00.097	0.087
79	00.053	-0.149	-0.153	-0.076	00.012	00.248	0.087
80	-0.047	-0.148	00.051	-0.078	00.065	00.074	0.087
81	-0.186	-0.238	00.238	-0.110	-0.072	00.351	0.087
82	-0.029	-0.118	00.063	-0.095	00.071	00.036	0.087
83	00.147	00.044	-0.163	00.025	00.013	00.168	0.087
84	00.062	-0.156	00.079	-0.035	00.079	00.034	0.087
85	00.321	00.049	-0.075	00.093	00.030	-0.150	0.087
86	-0.027	-0.143	00.031	00.056	-0.049	00.111	0.087
87	00.109	-0.006	00.054	-0.008	00.001	-0.101	0.087
88	00.210	-0.036	00.021	-0.048	00.022	-0.023	0.087
89	00.003	00.073	00.094	00.008	00.077	-0.157	0.087
90	00.039	00.174	-0.014	-0.015	-0.007	00.098	0.087

Table A-6(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
91	-0.038	-0.136	00.089	-0.071	00.121	00.030	0.087
92	00.077	-0.057	-0.079	-0.013	00.159	00.079	0.087
93	00.067	-0.040	00.011	-0.039	00.078	00.102	0.087
94	-0.023	-0.162	00.079	-0.041	00.107	00.074	0.087
95	00.134	00.012	-0.074	00.038	-0.032	00.080	0.087
96	00.029	-0.148	00.084	00.083	-0.014	-0.080	0.090
97	00.196	00.021	00.081	-0.089	00.087	-0.110	0.090
98	00.177	-0.040	00.138	00.001	00.081	-0.141	0.090
99	-0.006	-0.135	-0.046	00.148	00.131	-0.121	0.090
100	00.239	00.080	00.165	00.152	00.021	-0.100	0.090
101	00.081	-0.238	00.100	00.023	00.107	00.066	0.090
102	00.229	00.024	00.006	00.142	-0.050	-0.117	0.090
103	-0.166	-0.032	00.117	-0.092	00.061	00.079	0.090

Table A-7A. Estimated autocorrelations for residuals from dummy variable regressions for fund sample

Fund	p1	p2	p3	p4	p5	p6	SE
1	-0.015	-0.035	00.036	00.194	-0.008	00.079	0.088
2	-0.195	-0.052	00.048	00.007	00.027	-0.046	0.088
3	-0.051	00.012	00.008	00.066	-0.026	00.024	0.088
4	-0.153	00.103	00.135	00.061	00.032	00.029	0.088
5	-0.097	00.070	00.137	00.012	00.159	00.054	0.088
6	-0.099	00.050	00.188	-0.063	00.003	00.018	0.088
7	-0.194	00.147	-0.046	00.084	00.087	00.176	0.088
8	00.013	-0.019	00.004	00.029	00.152	-0.006	0.088
9	-0.325	-0.124	00.209	-0.023	-0.184	00.256	0.088
10	-0.035	-0.075	-0.002	00.069	00.121	-0.140	0.088
11	-0.073	00.027	-0.065	00.046	00.068	-0.010	0.088
12	-0.130	00.015	00.043	-0.058	00.006	00.026	0.088
13	-0.260	-0.066	00.066	-0.057	00.125	-0.053	0.088
14	00.077	-0.035	00.075	00.102	-0.050	-0.049	0.088
15	00.085	-0.019	00.195	00.105	-0.028	00.019	0.088
16	-0.188	-0.123	-0.050	00.022	00.037	00.024	0.088
17	-0.258	-0.063	00.200	00.006	-0.059	00.076	0.088
18	-0.102	00.044	-0.116	00.057	-0.007	-0.013	0.088
19	-0.049	-0.246	-0.050	00.228	-0.047	-0.117	0.088
20	-0.207	00.039	-0.013	-0.045	00.135	-0.054	0.088
21	-0.551	00.276	-0.155	00.085	-0.042	-0.062	0.088
22	-0.062	00.024	-0.057	00.032	-0.051	00.004	0.088
23	-0.298	00.087	00.010	-0.091	-0.013	-0.085	0.088
24	-0.002	-0.057	00.114	00.062	-0.063	-0.053	0.088
25	-0.280	-0.002	-0.034	-0.020	-0.055	-0.014	0.088
26	-0.153	-0.217	00.070	00.092	-0.075	-0.034	0.088
27	00.034	00.098	00.201	-0.087	-0.003	-0.023	0.088
28	-0.058	00.138	00.087	-0.103	00.077	-0.085	0.088
29	-0.144	00.041	00.033	00.043	-0.055	00.087	0.088
30	-0.085	00.027	00.003	-0.004	00.008	00.072	0.088
31	00.073	00.001	-0.096	00.132	-0.019	-0.122	0.088
32	-0.278	00.095	-0.123	00.157	-0.053	00.207	0.088
33	-0.120	00.065	-0.114	00.149	-0.020	00.073	0.088
34	-0.152	-0.003	00.045	00.003	00.053	00.025	0.088
35	-0.109	-0.063	-0.058	00.078	-0.040	-0.045	0.088
36	-0.030	00.142	00.066	-0.035	-0.017	-0.137	0.088
37	-0.038	-0.011	-0.162	00.100	-0.046	-0.037	0.088
38	00.007	00.124	-0.045	-0.014	-0.237	-0.089	0.088
39	-0.392	00.097	00.002	00.094	-0.141	00.125	0.088
40	-0.155	-0.108	00.078	-0.017	-0.094	-0.0	0.088
41	-0.167	-0.153	00.022	-0.004	00.115	-0.067	0.088
42	-0.350	-0.062	00.017	-0.070	00.086	00.020	0.088
43	-0.042	-0.032	-0.147	00.144	-0.021	-0.079	0.088
44	-0.167	00.025	-0.018	-0.046	00.038	-0.040	0.088
45	-0.435	00.117	-0.037	00.006	00.002	-0.012	0.088

Table A-7A(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
46	-0.269	-0.020	00.050	00.077	-0.068	00.056	0.088
47	-0.072	00.027	-0.096	00.213	-0.077	00.047	0.088
48	-0.203	-0.103	00.129	-0.189	00.049	00.017	0.088
49	-0.177	-0.291	00.262	-0.086	-0.015	00.010	0.088
50	-0.109	00.062	00.128	-0.030	00.169	00.032	0.088
51	-0.119	00.045	00.054	-0.131	00.187	-0.102	0.088
52	-0.260	00.122	-0.096	-0.056	-0.106	-0.074	0.088
53	-0.125	00.080	-0.091	00.212	-0.205	00.029	0.088
54	00.025	-0.104	-0.052	-0.029	00.096	-0.052	0.088
55	-0.130	00.005	-0.075	-0.074	-0.158	-0.066	0.088
56	00.038	00.088	-0.157	00.050	00.062	00.036	0.088
57	-0.343	00.028	00.148	00.053	-0.004	-0.027	0.088
58	-0.084	-0.121	00.011	00.007	-0.002	00.047	0.088
59	00.042	-0.053	-0.046	00.205	00.077	00.004	0.088
60	-0.159	-0.031	-0.026	00.046	-0.030	-0.083	0.088
61	-0.574	00.356	-0.202	00.017	-0.016	-0.024	0.088
62	-0.160	-0.058	-0.051	00.034	00.152	-0.126	0.088
63	-0.234	-0.176	00.179	00.005	00.040	00.003	0.088
64	-0.095	00.007	-0.067	00.002	-0.148	-0.056	0.088
65	00.160	00.098	00.045	00.149	-0.051	-0.087	0.088
66	00.055	00.007	-0.014	00.013	00.031	-0.045	0.088
67	-0.210	00.055	00.053	-0.006	-0.105	00.009	0.088
68	-0.201	00.056	-0.021	-0.032	00.090	-0.101	0.088
69	-0.402	00.078	-0.109	00.172	00.005	00.044	0.088
70	-0.012	-0.011	-0.089	00.027	00.186	00.109	0.088
71	-0.144	00.088	00.042	00.130	00.093	00.093	0.088
72	-0.238	00.124	-0.093	-0.046	00.050	00.051	0.088
73	-0.119	-0.084	00.167	00.077	00.049	00.029	0.088
74	-0.007	00.082	00.113	-0.078	00.075	00.055	0.088
75	-0.155	00.164	00.020	-0.005	00.116	00.011	0.088
76	-0.155	00.023	00.006	-0.085	00.043	-0.063	0.088
77	-0.075	-0.172	-0.047	00.040	-0.019	-0.082	0.088
78	-0.434	-0.089	-0.108	00.062	00.065	-0.111	0.088
79	-0.114	00.032	-0.040	-0.023	-0.239	00.173	0.088
80	-0.270	-0.160	00.061	-0.005	00.078	-0.147	0.088
81	-0.252	-0.176	00.296	-0.083	-0.176	00.257	0.088
82	-0.014	00.035	00.103	-0.053	00.007	00.088	0.088
83	00.025	00.154	-0.080	00.046	-0.048	00.141	0.088
84	00.187	00.102	00.096	00.138	-0.107	00.135	0.088
85	00.307	00.171	-0.072	-0.009	-0.150	-0.190	0.088
86	-0.443	00.094	-0.090	00.070	-0.100	00.054	0.088
87	00.067	00.045	-0.007	00.029	00.012	-0.060	0.088
88	00.089	00.012	00.094	-0.180	-0.217	00.036	0.088
89	-0.064	00.121	-0.013	00.015	00.200	-0.111	0.088
90	-0.035	00.259	-0.027	-0.076	-0.169	00.059	0.088

Table A-7A(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
91	-0.241	00.040	-0.069	-0.153	-0.065	00.113	0.088
92	-0.065	00.051	00.061	00.043	00.055	00.075	0.088
93	00.072	00.019	00.033	-0.042	-0.038	-0.060	0.088
94	-0.053	-0.266	-0.285	00.006	00.201	00.014	0.088
95	-0.010	00.092	-0.026	-0.023	-0.271	-0.074	0.088
96	-0.308	-0.043	00.040	00.080	00.035	-0.044	0.090
97	00.076	00.132	00.206	-0.032	00.002	-0.049	0.090
98	00.057	00.043	00.205	00.038	00.088	-0.092	0.090
99	-0.088	-0.051	-0.057	00.045	00.119	-0.091	0.090
100	00.193	00.039	00.143	00.069	-0.026	-0.056	0.090
101	-0.038	-0.048	-0.005	-0.007	-0.052	-0.193	0.090
102	00.206	00.177	-0.035	-0.038	-0.060	-0.195	0.090
103	-0.510	00.024	00.063	-0.003	00.024	-0.088	0.090

Table A-7B. Estimated autocorrelations for residuals from independent regressions, 1971-1975 for fund sample

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
1	-0.185	-0.047	00.053	00.201	-0.028	00.012	0.120
2	00.0	00.0	00.0	00.0	00.0	00.0	0.0
3	-0.028	00.067	00.032	-0.027	-0.016	00.063	0.120
4	-0.156	-0.009	00.152	00.018	00.025	00.098	0.120
5	-0.133	00.203	00.058	00.074	00.145	00.038	0.120
6	00.100	-0.012	00.169	-0.103	-0.068	-0.150	0.120
7	-0.364	00.150	-0.069	00.010	00.051	00.146	0.120
8	00.079	-0.004	-0.121	00.045	00.137	00.080	0.120
9	-0.395	-0.150	00.232	00.005	-0.152	00.117	0.120
10	-0.135	00.042	-0.179	00.061	-0.071	-0.046	0.120
11	00.154	-0.093	-0.159	-0.045	00.136	-0.039	0.120
12	-0.277	00.054	-0.020	00.041	-0.051	00.050	0.120
13	-0.369	00.018	-0.045	00.052	00.019	-0.131	0.120
14	00.018	-0.092	00.046	00.072	-0.137	-0.265	0.120
15	-0.113	00.013	00.288	00.047	-0.051	00.171	0.120
16	-0.224	-0.213	00.076	00.059	00.004	-0.089	0.120
17	-0.428	-0.036	00.118	00.030	-0.073	-0.130	0.120
18	-0.085	00.216	-0.136	-0.122	-0.069	-0.011	0.120
19	-0.348	-0.151	00.037	00.309	-0.128	-0.207	0.120
20	-0.306	-0.066	00.077	-0.172	00.231	-0.108	0.120
21	-0.492	00.220	-0.201	00.173	-0.170	00.052	0.120
22	-0.090	00.060	-0.152	-0.118	00.024	00.013	0.120
23	-0.206	00.090	-0.125	00.068	-0.213	00.110	0.120
24	00.031	-0.054	00.103	-0.056	00.006	-0.053	0.120
25	-0.524	-0.015	00.171	-0.040	00.065	-0.170	0.120
26	-0.203	-0.237	00.263	00.103	-0.252	00.0	0.120
27	-0.021	00.064	00.197	-0.284	-0.009	-0.115	0.120
28	-0.121	00.162	00.109	-0.229	00.029	-0.093	0.120
29	-0.183	00.025	00.092	-0.040	00.071	00.123	0.120
30	00.134	-0.022	00.099	-0.090	00.103	00.238	0.120
31	00.061	00.064	-0.096	00.023	-0.247	-0.138	0.120
32	-0.253	00.094	00.006	00.255	-0.105	00.038	0.120
33	00.038	-0.016	00.095	-0.017	00.102	-0.061	0.120
34	-0.144	-0.060	00.074	00.010	00.014	00.062	0.120
35	-0.192	00.135	00.014	00.103	00.041	-0.019	0.120
36	-0.155	00.115	00.205	00.003	-0.046	00.081	0.120
37	00.036	00.049	-0.046	00.014	-0.096	-0.042	0.120
38	00.210	00.201	-0.107	-0.080	-0.358	-0.189	0.120
39	-0.300	00.142	-0.115	00.203	-0.239	00.071	0.120
40	-0.252	-0.092	00.027	-0.131	-0.091	00.166	0.120
41	-0.264	-0.158	00.088	-0.096	00.079	00.080	0.120
42	-0.405	-0.104	00.229	-0.074	00.063	-0.016	0.120
43	00.108	-0.183	-0.195	00.133	00.001	-0.073	0.120
44	-0.323	00.012	-0.019	-0.057	00.119	-0.094	0.120
45	-0.362	00.199	-0.038	-0.187	00.079	-0.026	0.120

Table A-7B(cont'd)

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
46	-0.183	-0.127	00.164	00.057	-0.069	-0.041	0.120
47	-0.152	00.184	-0.115	00.132	-0.200	00.068	0.120
48	-0.280	-0.129	00.325	-0.342	00.005	00.132	0.120
49	-0.212	-0.376	00.320	-0.131	00.002	00.034	0.120
50	-0.230	00.036	00.075	00.045	00.126	-0.104	0.120
51	-0.235	-0.018	00.112	-0.222	00.273	-0.058	0.120
52	-0.009	-0.026	-0.042	-0.099	-0.274	-0.217	0.120
53	-0.216	00.071	-0.177	00.177	-0.193	00.015	0.120
54	00.004	-0.074	-0.096	-0.110	00.113	-0.064	0.120
55	-0.304	-0.105	00.136	-0.001	-0.070	-0.083	0.120
56	00.056	00.069	-0.266	00.048	00.016	00.092	0.120
57	-0.404	00.009	00.180	00.036	-0.047	-0.061	0.120
58	-0.105	-0.056	00.018	00.041	-0.034	-0.181	0.120
59	-0.124	-0.104	-0.014	00.051	00.077	-0.122	0.120
60	-0.112	-0.188	-0.077	-0.023	00.123	-0.170	0.120
61	-0.521	00.213	-0.200	00.211	-0.138	-0.003	0.120
62	-0.142	-0.137	-0.002	-0.082	00.187	-0.117	0.120
63	-0.355	-0.208	00.281	-0.094	00.024	-0.047	0.120
64	-0.282	00.282	00.025	-0.011	00.036	-0.183	0.120
65	00.283	00.138	00.058	00.074	-0.008	-0.053	0.120
66	00.047	00.045	-0.005	00.002	-0.044	-0.091	0.120
67	-0.333	00.093	00.097	-0.103	-0.004	-0.094	0.120
68	-0.258	-0.009	00.099	-0.184	-0.009	-0.203	0.120
69	-0.468	00.202	-0.138	00.133	00.022	00.066	0.120
70	00.094	-0.061	-0.036	-0.121	00.094	00.074	0.120
71	00.200	00.152	00.124	00.086	00.190	00.048	0.120
72	-0.207	00.127	-0.089	-0.148	00.104	00.049	0.120
73	-0.108	00.011	00.196	-0.156	00.036	-0.096	0.120
74	-0.307	-0.135	00.036	-0.151	00.144	-0.038	0.120
75	-0.183	00.175	-0.036	-0.020	00.105	-0.035	0.120
76	-0.339	00.096	00.127	-0.061	00.113	00.168	0.120
77	-0.157	-0.006	00.051	00.172	00.073	-0.040	0.120
78	-0.366	00.022	-0.109	00.030	00.176	00.231	0.120
79	-0.077	00.026	-0.077	00.034	-0.277	-0.100	0.120
80	-0.287	-0.218	00.104	-0.023	00.126	-0.263	0.120
81	-0.352	00.009	00.135	-0.038	-0.100	00.189	0.120
82	00.100	00.201	-0.059	-0.071	-0.206	00.207	0.120
83	-0.087	00.164	-0.017	00.004	-0.136	00.240	0.120
84	00.294	00.165	-0.013	00.047	-0.085	00.206	0.120
85	00.341	00.200	00.006	00.137	-0.073	-0.175	0.120
86	-0.075	-0.108	-0.131	-0.075	-0.212	00.246	0.120
87	00.178	00.151	-0.141	-0.010	-0.105	00.009	0.120
88	-0.021	-0.042	00.298	-0.214	-0.169	00.050	0.120
89	00.033	00.200	-0.072	00.018	00.200	-0.022	0.120
90	00.0	00.0	00.0	00.0	00.0	00.0	0.0

Table A-7B(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
91	-0.119	-0.247	00.098	-0.338	-0.120	00.267	0.120
92	-0.214	00.143	00.032	-0.006	00.061	-0.035	0.120
93	00.104	-0.028	00.044	-0.093	00.037	00.036	0.120
94	-0.008	-0.277	-0.377	-0.021	00.232	00.067	0.120
95	-0.169	-0.021	00.111	00.097	-0.327	-0.012	0.120
96	-0.165	00.076	00.095	-0.119	00.073	-0.083	0.123
97	-0.029	00.165	00.190	-0.270	-0.030	-0.073	0.123
98	-0.020	00.077	00.218	-0.162	00.060	-0.106	0.123
99	-0.240	-0.133	00.030	00.125	00.043	-0.078	0.123
100	00.081	00.067	00.197	-0.064	-0.006	-0.053	0.123
101	-0.073	-0.006	00.073	00.039	-0.087	-0.303	0.123
102	00.129	00.174	-0.067	00.180	-0.164	-0.296	0.123
103	-0.357	-0.027	00.094	-0.150	00.034	00.023	0.123

Table A-7C. Estimated autocorrelations for residuals, from independent regressions, 1976-1980 for fund sample

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
1	00.065	00.069	00.035	00.270	-0.025	00.002	0.119
2	00.0	00.0	00.0	00.0	00.0	00.0	0.0
3	-0.054	-0.122	-0.038	00.210	-0.073	-0.188	0.119
4	-0.123	-0.369	-0.045	00.092	00.076	00.009	0.119
5	-0.195	-0.048	00.082	-0.102	00.077	-0.036	0.119
6	00.0	00.0	00.0	00.0	00.0	00.0	0.0
7	00.058	-0.241	-0.151	00.128	00.194	00.103	0.119
8	-0.107	-0.025	00.033	-0.031	00.122	-0.073	0.119
9	-0.139	-0.039	00.115	00.023	-0.203	00.255	0.119
10	00.044	-0.175	00.020	00.015	00.229	-0.119	0.119
11	-0.051	00.029	-0.062	00.270	00.074	00.078	0.119
12	00.030	-0.197	00.057	-0.117	00.075	00.150	0.119
13	-0.255	-0.213	00.170	-0.055	00.114	00.019	0.119
14	00.130	00.035	00.123	00.068	00.097	00.187	0.119
15	00.295	00.145	00.127	-0.063	-0.248	-0.308	0.119
16	-0.155	-0.013	-0.235	00.040	00.007	00.154	0.119
17	-0.146	-0.055	00.112	-0.012	-0.057	00.110	0.119
18	-0.175	-0.065	-0.142	00.163	-0.059	00.135	0.119
19	-0.040	-0.248	-0.055	00.222	-0.045	-0.075	0.119
20	-0.098	00.082	00.038	00.121	00.056	00.048	0.119
21	-0.603	00.204	00.016	-0.074	00.053	00.003	0.119
22	-0.059	-0.047	00.009	00.186	-0.088	00.070	0.119
23	-0.328	00.119	00.071	-0.188	00.118	-0.226	0.119
24	-0.046	00.009	-0.039	-0.075	-0.047	-0.143	0.119
25	00.102	00.021	-0.210	-0.030	-0.188	00.108	0.119
26	00.013	-0.080	-0.094	00.083	00.160	-0.115	0.119
27	00.029	00.031	00.189	00.113	-0.028	00.048	0.119
28	-0.012	00.033	00.055	00.059	00.146	-0.013	0.119
29	-0.146	00.103	-0.133	00.145	-0.214	00.105	0.119
30	-0.286	00.136	-0.123	00.056	-0.178	00.024	0.119
31	00.134	-0.231	-0.073	00.195	00.109	-0.116	0.119
32	-0.291	00.133	-0.216	00.050	-0.032	00.343	0.119
33	-0.220	00.098	-0.287	00.216	-0.114	00.259	0.119
34	00.094	-0.048	-0.092	-0.091	00.092	-0.111	0.119
35	-0.089	-0.139	-0.234	00.008	-0.098	-0.032	0.119
36	-0.013	00.129	-0.021	-0.014	00.008	-0.130	0.119
37	-0.201	-0.021	-0.202	00.201	-0.075	-0.054	0.119
38	-0.264	-0.069	00.108	-0.032	-0.209	00.002	0.119
39	-0.443	-0.087	00.177	-0.120	-0.138	00.162	0.119
40	-0.079	-0.129	00.143	00.016	-0.209	-0.029	0.119
41	-0.130	-0.056	-0.165	00.067	00.215	00.016	0.119
42	-0.268	00.026	-0.195	00.008	00.101	00.024	0.119
43	-0.248	00.139	-0.139	00.065	-0.056	-0.039	0.119
44	-0.264	00.097	-0.163	-0.085	-0.010	00.168	0.119
45	-0.423	00.012	-0.010	00.116	00.041	00.023	0.119

Table A-7C(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
46	-0.355	00.048	-0.088	00.113	-0.076	00.122	0.119
47	-0.096	-0.131	-0.165	00.203	-0.030	-0.117	0.119
48	-0.165	-0.137	00.061	-0.029	00.002	-0.018	0.119
49	-0.065	-0.107	00.043	-0.034	-0.034	-0.098	0.119
50	00.020	00.001	00.123	-0.064	00.034	00.187	0.119
51	00.076	00.018	00.023	00.032	-0.020	-0.181	0.119
52	-0.467	00.235	-0.091	-0.156	00.069	00.048	0.119
53	-0.025	00.075	-0.018	00.200	-0.231	-0.007	0.119
54	00.057	-0.252	-0.109	-0.031	00.110	00.042	0.119
55	-0.041	00.129	-0.121	-0.046	-0.221	-0.074	0.119
56	-0.018	-0.016	-0.138	-0.060	00.242	00.035	0.119
57	-0.231	-0.025	00.040	-0.050	-0.112	00.140	0.119
58	-0.122	-0.207	00.087	00.062	-0.057	00.122	0.119
59	00.243	00.025	-0.023	00.326	00.129	00.179	0.119
60	-0.184	00.144	-0.013	00.104	-0.024	00.022	0.119
61	-0.596	00.337	-0.210	00.169	-0.035	-0.039	0.119
62	-0.144	00.069	-0.200	00.007	00.078	-0.046	0.119
63	-0.102	-0.110	00.068	00.189	-0.001	-0.021	0.119
64	-0.050	00.012	-0.068	-0.026	-0.106	-0.117	0.119
65	00.059	00.147	00.054	00.129	-0.070	00.020	0.119
66	-0.019	-0.076	-0.053	00.048	00.232	-0.048	0.119
67	-0.024	-0.051	-0.024	00.064	00.041	-0.150	0.119
68	-0.130	00.064	-0.085	00.046	-0.001	-0.013	0.119
69	-0.233	-0.024	00.051	00.154	-0.070	00.114	0.119
70	-0.215	00.083	-0.163	00.121	00.243	00.081	0.119
71	-0.376	00.103	-0.116	00.048	-0.036	00.085	0.119
72	-0.364	00.127	-0.085	00.112	-0.150	00.112	0.119
73	-0.198	-0.256	00.136	00.163	00.003	00.078	0.119
74	00.089	00.025	00.172	-0.057	00.046	00.137	0.119
75	-0.160	00.014	00.061	-0.070	-0.011	00.048	0.119
76	-0.094	-0.044	-0.051	-0.109	-0.006	-0.139	0.119
77	-0.061	-0.238	-0.164	-0.040	-0.098	-0.048	0.119
78	-0.497	00.198	-0.158	00.095	-0.020	00.006	0.119
79	-0.097	00.032	-0.131	-0.183	-0.274	00.282	0.119
80	-0.246	00.101	00.069	-0.026	-0.026	00.091	0.119
81	-0.184	-0.287	00.401	-0.185	-0.149	00.270	0.119
82	-0.178	-0.028	00.195	-0.218	-0.013	-0.025	0.119
83	00.129	-0.001	-0.160	-0.056	00.020	-0.075	0.119
84	00.050	00.004	00.262	00.249	-0.183	00.026	0.119
85	00.287	00.245	-0.039	-0.144	-0.218	-0.338	0.119
86	-0.341	00.200	00.006	00.137	-0.073	-0.175	0.119
87	-0.069	-0.057	00.056	-0.004	00.215	-0.066	0.119
88	00.162	00.118	-0.050	-0.183	-0.197	-0.195	0.119
89	-0.176	00.031	-0.056	00.055	00.142	-0.091	0.119
90	00.468	00.283	00.015	-0.031	-0.267	-0.381	0.119

Table A-7C(cont'd)

Fund	b_1	b_2	b_3	b_4	b_5	b_6	SE
91	-0.387	00.232	-0.151	-0.044	-0.019	00.068	0.119
92	-0.086	-0.007	-0.027	-0.026	-0.027	00.090	0.119
93	-0.420	00.251	-0.135	-0.102	00.067	-0.019	0.119
94	-0.041	00.077	00.078	00.101	-0.012	-0.241	0.119
95	00.101	00.201	00.078	-0.161	-0.168	-0.202	0.119
96	-0.261	-0.039	00.104	00.221	-0.043	00.014	0.119
97	00.135	00.122	00.179	00.071	00.091	-0.180	0.119
98	00.247	-0.063	00.083	00.195	00.100	-0.067	0.119
99	00.008	-0.022	-0.151	-0.014	00.111	-0.087	0.119
100	00.211	00.060	00.103	00.187	00.028	-0.055	0.119
101	00.089	-0.103	-0.137	-0.149	-0.031	00.014	0.119
102	00.216	00.358	-0.085	-0.071	-0.377	-0.152	0.119
103	-0.560	00.042	00.036	00.069	-0.024	-0.081	0.119

Table A-8. Comparison of Grant's results to results from this study

Fund	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$	$\hat{b}^4$	R^2*	R^2†	R^2††
5	0.84	0.62	0.77	0.68	0.59	0.64	0.56
8	0.99	0.63	0.62	0.60	0.33	0.39	0.41
9	0.65	0.68	0.83	0.83	0.69	0.60	0.67
13	0.73	0.70	0.71	0.57	0.63	0.79	0.79
19	0.74	0.72	0.86	0.86	0.69	0.84	0.72
25	0.67	0.72	0.88	0.81	0.52	0.70	0.64
26	0.59	0.51	0.97	0.87	0.38	0.59	0.50
30	0.89	0.69	0.91	0.98	0.53	0.62	0.52
42	0.83	0.75	0.90	0.85	0.66	0.77	0.74
44	0.70	0.61	0.59	0.59	0.63	0.64	0.69
48	0.84	0.69	0.86	0.86	0.67	0.79	0.76
51	0.95	0.87	0.87	0.87	0.37	0.73	0.71
63	0.69	0.75	0.92	0.81	0.24	0.72	0.75
36	0.54	0.38	0.82	0.92	0.44	0.52	0.40
68	0.80	0.73	1.05	0.93	0.49	0.70	0.65
69	0.92	0.74	0.95	0.88	0.55	0.65	0.55
70	0.79	0.68	0.68	0.85	0.61	0.46	0.56

[1]: estimate from Grant's study
[2]: estimate from simple regression(first model), this study
[3]: estimate from independent regression, first subperiod
[4]: estimate from dummy variable regression
*: R^2, Grant's study
†: R^2, from independent regression
††: R^2, from dummy variable regression

SOURCE: Grant, D.(1976): Investment performance of Canadian mutual funds: 1960-74; *Journal of Business Administration*, Vol. 8, pp. 1-10.

Table A-9A. Sharpe Indexes, 1971-1975, for fund sample

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
1	-0.1092	-0.1078	00.1295
2	00.1300	00.1284	00.1296
3	-0.0374	-0.0369	00.1291
4	-0.1987	-0.1962	00.1304
5	-0.2183	-0.2156	00.1306
6	00.0783	00.0773	00.1293
7	-0.1293	-0.1277	00.1296
8	-0.1432	-0.1414	00.1298
9	-0.0491	-0.0485	00.1292
10	-0.0879	-0.0868	00.1293
11	-0.0178	-0.0176	00.1291
12	-0.1348	-0.1332	00.1297
13	-0.0674	-0.0666	00.1292
14	-0.0529	-0.0522	00.1292
15	-0.0158	-0.0156	00.1291
16	-0.1000	-0.0988	00.1294
17	-0.0035	-0.0035	00.1291
18	-0.1192	-0.1177	00.1296
19	-0.0719	-0.0710	00.1293
20	-0.1055	-0.1042	00.1295
21	-0.0172	-0.0170	00.1291
22	-0.1576	-0.1557	00.1299
23	-0.0467	-0.0461	00.1292
24	-0.2326	-0.2298	00.1308
25	00.0312	00.0308	00.1291
26	00.0196	00.0194	00.1291
27	-0.0303	-0.0299	00.1291
28	-0.0285	-0.0281	00.1291
29	-0.1067	-0.1054	00.1295
30	-0.0825	-0.0815	00.1293
31	00.0694	00.0686	00.1293
32	-0.1133	-0.1119	00.1295
33	-0.1048	-0.1035	00.1295
34	-0.1526	-0.1507	00.1298
35	-0.1104	-0.1090	00.1295
36	-0.1215	-0.1200	00.1296
37	00.0610	00.0603	00.1292
38	00.2251	00.2223	00.1307
39	-0.1197	-0.1182	00.1296
40	-0.1941	-0.1917	00.1303
41	-0.0625	-0.0617	00.1292
42	-0.0662	-0.0654	00.1292
43	-0.1525	-0.1506	00.1298
44	-0.0833	-0.0823	00.1293
45	-0.0410	-0.0405	00.1292

Table A-9A(cont'd)

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
46	-0.1961	-0.1937	00.1303
47	-0.1028	-0.1015	00.1294
48	-0.0307	-0.0303	00.1291
49	-0.0513	-0.0507	00.1292
50	-0.0554	-0.0547	00.1292
51	-0.1269	-0.1253	00.1296
52	-0.0740	-0.0731	00.1293
53	-0.0626	-0.0619	00.1292
54	-0.0820	-0.0810	00.1293
55	-0.1493	-0.1474	00.1298
56	-0.0507	-0.0501	00.1292
57	-0.1316	-0.1299	00.1297
58	-0.0837	-0.0826	00.1293
59	-0.0312	-0.0308	00.1291
60	-0.1048	-0.1035	00.1295
61	-0.0233	-0.0230	00.1291
62	-0.1289	-0.1274	00.1296
63	-0.0543	-0.0536	00.1292
64	-0.0914	-0.0902	00.1294
65	-0.1472	-0.1454	00.1298
66	00.1232	00.1216	00.1296
67	00.0424	00.0419	00.1292
68	00.0048	00.0048	00.1291
69	-0.1295	-0.1279	00.1296
70	-0.2791	-0.2756	00.1316
71	-0.1944	-0.1920	00.1303
72	-0.1751	-0.1730	00.1301
73	-0.0436	-0.0430	00.1292
74	-0.1318	-0.1302	00.1297
75	-0.1884	-0.1860	00.1302
76	-0.2052	-0.2026	00.1305
77	-0.0761	-0.0751	00.1293
78	-0.0479	-0.0473	00.1292
79	-0.0816	-0.0806	00.1293
80	-0.0092	-0.0091	00.1294
81	-0.0381	-0.0376	00.1291
82	-0.0580	-0.0573	00.1292
83	-0.0523	-0.0516	00.1292
84	-0.0817	-0.0807	00.1293
85	-0.0663	-0.0655	00.1292
86	-0.0408	-0.0403	00.1292
87	-0.1414	-0.1397	00.1297
88	00.0069	00.0068	00.1291
89	-0.1260	-0.1245	00.1296
90	00.0059	00.0058	00.1291

Table A-9A(cont'd)

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
91	-0.0531	-0.0525	00.1292
92	00.1351	00.1334	00.1297
93	-0.0421	-0.0416	00.1292
94	-0.0609	-0.0602	00.1292
95	00.0557	00.0550	00.1292
96	-0.0702	-0.0692	00.1363
97	-0.0658	-0.0649	00.1362
98	-0.1187	-0.1171	00.1366
99	-0.3351	-0.3305	00.1399
100	00.1083	00.1068	00.1365
101	-0.0655	-0.0646	00.1362
102	-0.0623	-0.0614	00.1362
103	-0.0984	-0.0970	00.1364

[1]as traditionally calculated
[2]adjusted

Table A-9B. Sharpe Indexes, 1976-1980, for fund sample

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
1	00.2928	00.2892	00.1318
2	00.1930	00.1907	00.1303
3	00.3174	00.3135	00.1323
4	00.2205	00.2178	00.1307
5	00.1697	00.1676	00.1300
6	00.0451	00.0445	00.1292
7	00.2147	00.2121	00.1306
8	00.1818	00.1796	00.1302
9	00.2422	00.2392	00.1310
10	00.1823	00.1800	00.1302
11	00.1404	00.1386	00.1297
12	00.3897	00.3849	00.1339
13	00.1135	00.1121	00.1295
14	00.2431	00.2401	00.1310
15	-0.1479	-0.1461	00.1298
16	00.1785	00.1763	00.1301
17	00.1461	00.1443	00.1298
18	00.1918	00.1895	00.1303
19	00.1457	00.1439	00.1298
20	00.3569	00.3525	00.1331
21	00.1688	00.1668	00.1300
22	00.1082	00.1069	00.1295
23	-0.0839	-0.0829	00.1293
24	00.1794	00.1771	00.1301
25	00.1846	00.1823	00.1302
26	00.3454	00.3412	00.1329
27	00.1243	00.1228	00.1296
28	00.2362	00.2333	00.1309
29	00.2147	00.2121	00.1306
30	00.2450	00.2419	00.1310
31	00.1490	00.1472	00.1298
32	00.4124	00.4073	00.1345
33	00.2704	00.2671	00.1314
34	00.2886	00.2851	00.1318
35	00.1501	00.1482	00.1298
36	00.0290	00.0287	00.1291
37	00.2937	00.2901	00.1319
38	00.1022	00.1009	00.1294
39	00.0604	00.0597	00.1292
40	-0.0036	-0.0035	00.1291
41	00.0212	00.0209	00.1291
42	00.1435	00.1417	00.1298
43	00.1540	00.1521	00.1299
44	00.1605	00.1585	00.1299
45	00.2508	00.2477	00.1311

Table A-9B(cont'd)

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
46	00.0570	00.0563	00.1292
47	00.2569	00.2537	00.1312
48	00.1832	00.1810	00.1302
49	00.2177	00.2150	00.1306
50	00.1203	00.1189	00.1296
51	00.1713	00.1692	00.1300
52	00.1894	00.1871	00.1303
53	00.1556	00.1537	00.1299
54	00.1785	00.1763	00.1301
55	00.0981	00.0969	00.1294
56	00.2145	00.2118	00.1306
57	00.3411	00.3368	00.1328
58	00.1892	00.1868	00.1302
59	00.2348	00.2319	00.1309
60	00.1760	00.1738	00.1301
61	00.2206	00.2179	00.1307
62	00.0865	00.0854	00.1293
63	00.1132	00.1118	00.1295
64	00.0205	00.0203	00.1291
65	00.4181	00.4129	00.1346
66	00.3478	00.3435	00.1329
67	00.0775	00.0766	00.1293
68	00.0276	00.0272	00.1291
69	00.1718	00.1697	00.1300
70	00.1269	00.1253	00.1296
71	00.2401	00.2371	00.1309
72	00.2492	00.2461	00.1311
73	00.2933	00.2897	00.1318
74	00.1868	00.1845	00.1302
75	00.1858	00.1835	00.1302
76	00.1124	00.1110	00.1295
77	00.1288	00.1272	00.1296
78	00.1377	00.1360	00.1297
79	-0.0910	-0.0899	00.1294
80	00.1550	00.1531	00.1299
81	-0.0977	-0.0965	00.1294
82	00.1024	00.1012	00.1294
83	-0.0905	-0.0894	00.1294
84	00.2204	00.2177	00.1307
85	-0.1634	-0.1614	00.1300
86	00.1638	00.1618	00.1300
87	00.1259	00.1243	00.1296
88	-0.1001	-0.0989	00.1294
89	00.1306	00.1289	00.1296
90	-0.1328	-0.1312	00.1297

Table A-9B(cont'd)

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
91	00.1564	00.1545	00.1299
92	-0.0684	-0.0675	00.1293
93	00.0772	00.0762	00.1293
94	00.1669	00.1649	00.1300
95	-0.1309	-0.1293	00.1297
96	00.2015	00.1990	00.1304
97	00.2707	00.2674	00.1314
98	00.2691	00.2658	00.1314
99	00.0286	00.0282	00.1291
100	00.1186	00.1171	00.1296
101	00.2045	00.2020	00.1304
102	-0.1281	-0.1266	00.1296
103	00.1651	00.1630	00.1300

[1]as traditionally calculated
[2]adjusted

Table A-10A. Transformed Sharpe statistics, 1971-1975, for fund sample

Fund	shm[1]	zsh[2]
1	-0.0002	-0.7159
2	00.0008	01.0514
3	00.0000	00.0975
4	-0.0003	-1.5066
5	-0.0004	-1.8548
6	00.0002	00.7970
7	-0.0003	-0.7227
8	-0.0003	-0.8462
9	-0.0000	-0.0101
10	-0.0001	-0.4712
11	00.0001	00.2301
12	-0.0003	-1.1135
13	-0.0000	-0.3206
14	-0.0000	-0.0756
15	00.0000	00.2498
16	-0.0001	-0.7438
17	00.0001	00.7406
18	-0.0002	-0.6504
19	-0.0000	-0.4006
20	-0.0002	-0.6874
21	00.0001	00.4319
22	-0.0003	-0.9463
23	00.0000	00.0085
24	-0.0008	-1.6187
25	00.0002	00.9961
26	00.0001	00.6010
27	00.0000	00.1883
28	00.0001	00.2137
29	-0.0002	-0.4997
30	-0.0001	-0.3669
31	00.0007	00.7755
32	-0.0002	-0.9766
33	-0.0001	-0.6279
34	-0.0004	-0.8080
35	-0.0002	-0.7375
36	-0.0001	-0.5883
37	00.0003	00.9824
38	00.0007	02.0819
39	-0.0002	-0.8568
40	-0.0003	-1.2202
41	-0.0000	-0.2024
42	-0.0000	-0.2600
43	-0.0003	-0.9373
44	-0.0001	-0.3947
45	00.0000	00.0874

Table A-10A(cont'd)

Fund	shm[1]	zsh[2]
46	-0.0003	-1.2517
47	-0.0002	-0.8281
48	00.0000	00.2456
49	-0.0000	-0.0282
50	-0.0000	-0.1196
51	-0.0002	-1.0206
52	-0.0001	-0.3736
53	-0.0000	-0.1722
54	-0.0001	-0.2998
55	-0.0003	-1.0200
56	-0.0000	-0.0255
57	-0.0003	-0.9756
58	-0.0001	-0.4866
59	00.0001	00.1987
60	-0.0001	-0.6621
61	00.0001	00.3113
62	-0.0002	-0.6770
63	-0.0000	-0.0787
64	-0.0001	-0.6290
65	-0.0004	-1.0034
66	00.0005	01.2811
67	00.0002	00.9914
68	00.0001	00.5999
69	-0.0002	-0.7819
70	-0.0007	-1.8849
71	-0.0005	-1.6358
72	-0.0005	-1.1452
73	00.0000	00.0685
74	-0.0001	-0.6955
75	-0.0005	-1.1498
76	-0.0003	-1.6086
77	-0.0001	-0.3224
78	-0.0001	-0.7573
79	00.0000	00.2653
80	-0.0001	-0.5754
81	00.0000	00.0740
82	-0.0000	-0.2137
83	-0.0000	-0.0241
84	-0.0001	-0.9975
85	-0.0000	-0.1330
86	00.0000	00.2053
87	-0.0002	-0.8504
88	00.0000	00.3897
89	-0.0002	-0.8197
90	00.0001	00.3161

Table A-10A(cont'd)

Fund	shm[1]	zsh[2]
91	-0.0000	-0.1970
92	00.0001	01.2085
93	00.0000	00.0382
94	-0.0000	-0.1529
95	00.0001	00.6980
96	-0.0000	-0.0315
97	-0.0000	-0.0216
98	-0.0002	-0.6130
99	-0.0003	-1.6624
100	00.0005	01.1247
101	00.0000	00.0417
102	00.0000	00.0384
103	-0.0001	-0.5304

[1]transformed Sharpe Index
[2]standardized transformed Sharpe Index

Table A-10B. Transformed Sharpe statistics, 1976-1980, for fund sample

Fund	shm[1]	zsh[2]
1	00.0002	01.1486
2	00.0000	00.0052
3	00.0004	01.0804
4	00.0000	00.2695
5	-0.0000	-0.1974
6	-0.0002	-0.8930
7	00.0001	00.1755
8	-0.0000	-0.0933
9	00.0001	00.7625
10	-0.0000	-0.0783
11	-0.0001	-0.3638
12	00.0006	02.2711
13	-0.0002	-1.2052
14	00.0001	00.9370
15	-0.0002	-2.0633
16	-0.0000	-0.2210
17	-0.0001	-0.5759
18	-0.0000	-0.0027
19	-0.0001	-0.4090
20	00.0004	01.7122
21	-0.0001	-0.2628
22	-0.0002	-0.7424
23	-0.0005	-1.5870
24	-0.0000	-0.1016
25	-0.0000	-0.0815
26	00.0002	00.9738
27	-0.0001	-0.6208
28	00.0001	00.4692
29	00.0001	00.2124
30	00.0001	00.4487
31	-0.0003	-0.2812
32	00.0006	02.8629
33	00.0002	00.7628
34	00.0002	00.8982
35	-0.0001	-0.3652
36	-0.0005	-1.3274
37	00.0002	00.8559
38	-0.0002	-0.6439
39	-0.0002	-0.9964
40	-0.0004	-1.4833
41	-0.0003	-1.7242
42	-0.0001	-0.6571
43	-0.0001	-0.3331
44	-0.0001	-0.3795
45	00.0002	00.6901

Table A-10B(cont'd)

Fund	shm[1]	zsh[2]
46	-0.0003	-1.2094
47	00.0002	00.9370
48	-0.0000	-0.1221
49	00.0001	00.3386
50	-0.0002	-1.4894
51	-0.0000	-0.2249
52	-0.0000	-0.0306
53	-0.0001	-0.3375
54	-0.0000	-0.1213
55	-0.0003	-0.9011
56	00.0001	00.2120
57	00.0004	02.1456
58	-0.0000	-0.0305
59	00.0001	00.4116
60	-0.0000	-0.2024
61	00.0001	00.3561
62	-0.0003	-0.8741
63	-0.0002	-1.1861
64	-0.0005	-1.7224
65	00.0006	01.9625
66	00.0004	01.3859
67	-0.0002	-1.0463
68	-0.0003	-1.3699
69	-0.0001	-0.2369
70	-0.0002	-0.6468
71	00.0002	00.3679
72	00.0002	00.6556
73	00.0002	01.4519
74	-0.0000	-0.0358
75	-0.0000	-0.0781
76	-0.0002	-0.7811
77	-0.0002	-0.5242
78	-0.0001	-1.1669
79	-0.0004	-1.8567
80	-0.0001	-0.6701
81	-0.0002	-1.8536
82	-0.0002	-1.5002
83	-0.0002	-1.6911
84	00.0001	00.8520
85	-0.0003	-2.0578
86	-0.0001	-0.3866
87	-0.0001	-0.6576
88	-0.0003	-1.7096
89	-0.0001	-0.5371
90	-0.0003	-1.9181

Table A-10B(cont'd)

Fund	shm[1]	zsh[2]
91	-0.0001	-1.2342
92	-0.0002	-1.8842
93	-0.0003	-2.2564
94	-0.0001	-1.0989
95	-0.0003	-1.8578
96	00.0000	00.0745
97	00.0002	00.6720
98	00.0002	00.7228
99	-0.0002	-1.0809
100	-0.0002	-0.4219
101	00.0000	00.2827
102	-0.0002	-2.0620
103	-0.0001	-0.2469

[1]transformed Sharpe Index
[2]standardized transformed Sharpe Index

Table A-11A. Treynor Indexes, 1971-1975, for fund sample

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
1	-0.0071	-0.0063	00.0074
2	00.0460	00.0158	00.0128
3	-0.0030	-0.0025	00.0089
4	-0.0144	-0.0127	00.0082
5	-0.0148	-0.0133	00.0078
6	00.0162	00.0087	00.0171
7	-0.0106	-0.0070	00.0071
8	-0.0117	-0.0118	00.0107
9	-0.0033	-0.0027	00.0073
10	-0.0057	-0.0048	00.0072
11	-0.0019	-0.0010	00.0079
12	-0.0084	-0.0081	00.0078
13	-0.0039	-0.0047	00.0091
14	-0.0031	-0.0027	00.0067
15	-0.0016	-0.0018	00.0155
16	-0.0060	-0.0050	00.0065
17	-0.0002	-0.0002	00.0072
18	-0.0095	-0.0072	00.0080
19	-0.0041	-0.0034	00.0061
20	-0.0068	-0.0056	00.0069
21	-0.0010	-0.0010	00.0073
22	-0.0134	-0.0145	00.0120
23	-0.0248	-0.0034	00.0227
24	-0.0192	-0.0142	00.0077
25	00.0020	00.0017	00.0072
26	00.0016	00.0009	00.0062
27	-0.0021	-0.0016	00.0071
28	-0.0020	-0.0020	00.0091
29	-0.0093	-0.0069	00.0085
30	-0.0057	-0.0040	00.0063
31	00.0114	00.0104	00.0218
32	-0.0067	-0.0064	00.0073
33	-0.0071	-0.0066	00.0081
34	-0.0155	-0.0117	00.0100
35	-0.0072	-0.0054	00.0064
36	-0.0116	-0.0046	00.0050
37	00.0049	00.0042	00.0092
38	00.0231	00.0265	00.0147
39	-0.0077	-0.0064	00.0069
40	-0.0172	-0.0132	00.0087
41	-0.0038	-0.0033	00.0069
42	-0.0040	-0.0035	00.0068
43	-0.0123	-0.0095	00.0081
44	-0.0056	-0.0057	00.0089
45	-0.0026	-0.0022	00.0069

Table A-11A(cont'd)

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
46	-0.0171	-0.0104	00.0068
47	-0.0060	-0.0062	00.0078
48	-0.0019	-0.0016	00.0066
49	-0.0041	-0.0027	00.0069
50	-0.0032	-0.0027	00.0063
51	-0.0079	-0.0066	00.0068
52	-0.0044	-0.0037	00.0066
53	-0.0041	-0.0034	00.0070
54	-0.0068	-0.0067	00.0108
55	-0.0108	-0.0082	00.0071
56	-0.0037	-0.0043	00.0112
57	-0.0086	-0.0069	00.0068
58	-0.0051	-0.0040	00.0062
59	-0.0020	-0.0015	00.0063
60	-0.0069	-0.0053	00.0066
61	-0.0015	-0.0013	00.0070
62	-0.0115	-0.0059	00.0060
63	-0.0034	-0.0031	00.0074
64	-0.0054	-0.0062	00.0087
65	-0.0106	-0.0076	00.0067
66	00.0134	00.0084	00.0091
67	00.0029	00.0022	00.0069
68	00.0003	00.0003	00.0072
69	-0.0098	-0.0077	00.0077
70	-0.0253	-0.0164	00.0072
71	-0.0130	-0.0097	00.0064
72	-0.0141	-0.0141	00.0104
73	-0.0026	-0.0020	00.0060
74	-0.0119	-0.0111	00.0111
75	-0.0172	-0.0119	00.0081
76	-0.0145	-0.0096	00.0060
77	-0.0050	-0.0048	00.0082
78	-0.0044	-0.0048	00.0076
79	-0.0013	-0.0009	00.0135
80	-0.0062	-0.0068	00.0092
81	-0.0044	-0.0061	00.0219
82	-0.0032	-0.0032	00.0072
83	-0.0191	-0.0049	00.0207
84	-0.0043	-0.0040	00.0063
85	-0.0076	-0.0053	00.0109
86	-0.0022	-0.0022	00.0068
87	-0.0113	-0.0092	00.0085
88	00.0009	00.0005	00.0099
89	-0.0088	-0.0087	00.0090
90	00.0025	00.0006	00.0294

Table A-11A(cont'd)

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
91	-0.0028	-0.0029	00.0069
92	00.0218	00.0129	00.0129
93	-0.0092	-0.0031	00.0120
94	-0.0039	-0.0032	00.0068
95	00.0085	00.0050	00.0130
96	-0.0044	-0.0039	00.0076
97	-0.0046	-0.0037	00.0077
98	-0.0078	-0.0077	00.0088
99	-0.0550	-0.0420	00.0044
100	00.0168	00.0065	00.0089
101	-0.0038	-0.0034	00.0071
102	-0.0077	-0.0093	00.0217
103	-0.0058	-0.0051	00.0070

[1]as traditionally calculated
[2]as revised, using β estimated from dummy variable model

Table A-11B. Treynor Indexes, 1976-1980, for fund sample

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
1	00.0198	00.0148	00.0064
2	00.0828	na	na
3	00.0274	00.0167	00.0063
4	00.0172	00.0146	00.0085
5	00.0144	00.0186	00.0142
6	00.0122	-0.0722	00.2874
7	00.0221	00.0247	00.0145
8	00.0150	00.0135	00.0096
9	00.0146	00.0141	00.0075
10	00.0181	00.0121	00.0086
11	00.0185	00.0092	00.0087
12	00.0259	00.0209	00.0067
13	00.0068	00.0072	00.0082
14	00.0140	00.0108	00.0057
15	-0.0375	00.0080	00.0069
16	00.0106	00.0083	00.0060
17	00.0095	00.0071	00.0063
18	00.0155	00.0112	00.0075
19	00.0124	00.0115	00.0103
20	00.0255	00.0135	00.0047
21	00.0116	00.0086	00.0066
22	00.0092	00.0076	00.0092
23	-0.0410	00.0023	00.0054
24	00.0177	00.0097	00.0069
25	00.0130	00.0091	00.0064
26	00.0653	00.0120	00.0010
27	00.0101	00.0098	00.0103
28	00.0167	00.0165	00.0089
29	00.0169	00.0121	00.0072
30	00.0217	00.0114	00.0058
31	00.0260	00.0230	00.0205
32	00.0258	00.0283	00.0086
33	00.0205	00.0159	00.0074
34	00.0229	00.0205	00.0088
35	00.0130	00.0066	00.0057
36	00.0028	00.0051	00.0236
37	00.0262	00.0171	00.0071
38	00.0128	00.0106	00.0141
39	00.0066	00.0065	00.0146
40	-0.0004	-0.0002	00.0087
41	00.0016	00.0012	00.0073
42	00.0090	00.0072	00.0065
43	00.0132	00.0114	00.0096
44	00.0106	00.0096	00.0077
45	00.0167	00.0127	00.0065

Table A-11B(cont'd)

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
46	00.0047	00.0047	00.0108
47	00.0157	00.0152	00.0076
48	00.0114	00.0088	00.0062
49	00.0138	00.0141	00.0083
50	00.0068	00.0060	00.0065
51	00.0121	00.0091	00.0069
52	00.0129	00.0095	00.0065
53	00.0125	00.0124	00.0104
54	00.0149	00.0141	00.0102
55	00.0076	00.0060	00.0080
56	00.0168	00.0133	00.0079
57	00.0207	00.0141	00.0053
58	00.0138	00.0127	00.0086
59	00.0180	00.0100	00.0054
60	00.0114	00.0078	00.0057
61	00.0143	00.0119	00.0069
62	00.0080	00.0070	00.0108
63	00.0068	00.0077	00.0088
64	00.0015	00.0013	00.0086
65	00.0350	00.0343	00.0093
66	00.0287	00.0441	00.0152
67	00.0063	00.0103	00.0175
68	00.0025	00.0016	00.0077
69	00.0115	00.0099	00.0074
70	00.0095	00.0111	00.0114
71	00.0253	00.0112	00.0058
72	00.0168	00.0154	00.0079
73	00.0179	00.0174	00.0076
74	00.0293	00.0185	00.0123
75	00.0121	00.0088	00.0061
76	00.0085	00.0086	00.0100
77	00.0119	00.0058	00.0059
78	00.0077	00.0065	00.0061
79	-0.0150	-0.1037	00.1625
80	00.0090	00.0080	00.0066
81	-0.0181	00.0159	00.0236
82	00.0060	00.0065	00.0082
83	-0.0268	00.0037	00.0069
84	00.0120	00.0122	00.0071
85	-0.0670	00.0041	00.0010
86	00.0102	00.0101	00.0080
87	00.0095	00.0070	00.0072
88	-0.0377	00.0027	00.0045
89	00.0112	00.0111	00.0111
90	-0.0439	00.0040	00.0036

Table A-11B(cont'd)

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
91	00.0084	00.0082	00.0068
92	-0.0082	00.0044	00.0089
93	00.0044	00.0056	00.0094
94	00.0089	00.0091	00.0070
95	-0.0610	00.0028	00.0010
96	00.0197	00.0125	00.0079
97	00.0237	00.0410	00.0188
98	00.0212	00.0196	00.0091
99	00.0047	00.0044	00.0225
100	00.0652	00.0129	00.0010
101	00.0114	00.0108	00.0068
102	-0.0227	00.0052	00.0056
103	00.0135	00.0071	00.0055

[1]as traditionally calculated
[2]as revised, using β estimated from dummy variable model

Table A-12A. Jensen Indexes and transformed Treynor statistics, 1971-1975, for fund sample

Fund	jn	trm[1]	ztr[2]
1	00.0004	-0.0036	-1.1047
2	00.0090	00.0122	01.1262
3	00.0030	-0.0001	-0.0168
4	00.0	-0.0068	-2.0120
5	-0.0070	-0.0075	-2.4697
6	00.0030	00.0036	00.7984
7	00.0060	-0.0057	-1.6329
8	-0.0020	-0.0059	-1.1088
9	00.0010	-0.0003	-0.0995
10	-0.0010	-0.0023	-0.8555
11	-0.0020	00.0011	00.3166
12	-0.0140	-0.0058	-1.3455
13	00.0010	-0.0013	-0.3646
14	-0.0020	-0.0003	-0.2192
15	-0.0002	00.0001	00.0397
16	-0.0020	-0.0023	-2.3398
17	-0.0010	00.0020	00.8202
18	-0.0020	-0.0043	-1.0821
19	-0.0004	-0.0008	-0.8262
20	-0.0030	-0.0031	-1.4748
21	00.0020	00.0013	00.5007
22	-0.0040	-0.0076	-1.2096
23	00.0020	-0.0010	-0.2756
24	-0.0010	-0.0156	-2.6052
25	00.0010	00.0034	01.4178
26	00.0030	00.0030	02.9664
27	00.0020	00.0006	00.3194
28	00.0040	00.0004	00.0755
29	-0.0010	-0.0037	-0.8400
30	-0.0005	-0.0016	-1.5580
31	00.0100	00.0093	00.6778
32	-0.0100	-0.0045	-1.2828
33	00.0030	-0.0030	-0.8653
34	-0.0140	-0.0083	-1.2222
35	-0.0050	-0.0043	-4.3053
36	-0.0030	-0.0021	-2.1450
37	00.0070	00.0048	01.0659
38	00.0060	00.0124	02.0826
39	-0.0020	-0.0039	-1.8293
40	-0.0100	-0.0059	-1.7991
41	-0.0040	-0.0007	-0.4194
42	-0.0020	-0.0009	-0.6516
43	-0.0040	-0.0065	-1.4759
44	00.0004	-0.0019	-0.5490
45	00.0020	00.0003	00.1393

Table A-12A(cont'd)

Fund	jn	trm[1]	ztr[2]
46	-0.0050	-0.0069	-3.3071
47	-0.0005	-0.0036	-0.9085
48	-0.0010	00.0007	00.7260
49	00.0010	-0.0003	-0.1372
50	-0.0020	-0.0002	-0.2200
51	00.0010	-0.0040	-2.7017
52	-0.0010	-0.0012	-1.2279
53	-0.0003	-0.0010	-0.3891
54	-0.0020	-0.0039	-0.5137
55	-0.0050	-0.0060	-2.0380
56	-0.0004	-0.0014	-0.2133
57	-0.0010	-0.0062	-2.5181
58	-0.0010	-0.0020	-1.9612
59	-0.0001	00.0016	01.5542
60	-0.0010	-0.0028	-2.8180
61	00.0010	00.0011	00.4864
62	-0.0040	-0.0046	-4.6237
63	-0.0010	-0.0005	-0.1937
64	-0.0040	-0.0029	-0.6490
65	-0.0100	-0.0071	-3.4544
66	00.0100	00.0091	01.7128
67	00.0020	00.0044	02.2450
68	-0.0010	00.0024	00.9357
69	-0.0030	-0.0046	-1.2865
70	-0.0150	-0.0138	-3.4063
71	-0.0050	-0.0099	-9.9259
72	-0.0040	-0.0106	-1.4344
73	-0.0050	00.0004	00.3654
74	-0.0010	-0.0033	-0.9892
75	-0.0060	-0.0114	-1.8618
76	-0.0040	-0.0058	-5.8328
77	-0.0040	-0.0027	-0.4862
78	-0.0020	-0.0021	-0.6283
79	-0.0010	00.0003	00.1274
80	-0.0030	-0.0037	-0.6812
81	-0.0005	-0.0003	-0.1916
82	-0.0005	-0.0006	-0.2713
83	00.0002	-0.0007	-0.3075
84	-0.0002	-0.0015	-1.4550
85	-0.0010	-0.0005	-0.3612
86	00.0002	00.0003	00.1748
87	-0.0040	-0.0052	-1.2621
88	00.0010	00.0007	00.4048
89	-0.0020	-0.0053	-1.0254
90	00.0003	00.0003	00.1327

Table A-12A(cont'd)

Fund	jn	trm[1]	ztr[2]
91	-0.0010	-0.0003	-0.1843
92	00.0003	00.0016	01.3792
93	-0.0020	-0.0019	-0.1473
94	-0.0010	-0.0007	-0.4363
95	00.0007	00.0014	00.7144
96	-0.0020	-0.0003	-0.1331
97	00.0040	-0.0001	-0.0471
98	-0.0080	-0.0040	-0.8058
99	-0.003	-0.0057	-1.3588
100	00.0100	00.0067	01.8997
101	00.0001	00.0002	00.1662
102	00.0004	-0.0006	-0.3093
103	-0.0020	-0.0013	-1.3363

[1] transformed Treynor Index
[2] standardized transformed Treynor Index

Table A-12B. Jensen Indexes and transformed Treynor statistics, 1976-1980, for fund sample

Fund	jn	trm[1]	ztr[2]
1	00.0004	00.0041	04.1292
2	00.0090	na	na
3	00.0030	00.0070	04.4342
4	00.0100	00.0016	00.8607
5	00.0030	00.0030	00.6888
6	00.0	00.0011	00.3766
7	00.0060	00.0062	01.1069
8	-0.0020	00.0023	00.5188
9	00.0010	00.0027	01.2082
10	-0.0010	00.0016	00.4275
11	-0.0020	-0.0000	-0.0121
12	00.0060	00.0111	06.2830
13	00.0010	-0.0016	-0.5967
14	-0.0020	00.0007	00.7150
15	-0.0002	-0.0002	-0.1273
16	-0.0020	-0.0016	-1.5937
17	-0.0010	-0.0026	-2.6428
18	-0.0020	00.0011	00.3579
19	-0.0010	00.0006	00.2105
20	00.0030	00.0044	04.4306
21	00.0020	-0.0012	-1.2438
22	-0.0040	-0.0014	-0.3500
23	00.0020	00.0023	00.8418
24	-0.0090	-0.0000	-0.0136
25	00.0010	-0.0007	-0.6803
26	00.0030	00.0027	02.7210
27	00.0010	-0.0000	-0.0074
28	00.0040	00.0035	01.0625
29	-0.0010	00.0018	00.7341
30	-0.0005	00.0016	01.5881
31	00.0100	00.0107	00.7384
32	00.0100	00.0147	03.1167
33	00.0030	00.0045	01.6091
34	00.0060	00.0062	01.6495
35	-0.0050	-0.0047	-4.6810
36	-0.0030	-0.0014	-0.2069
37	00.0070	00.0052	01.9861
38	00.0060	00.0006	00.1045
39	-0.0020	-0.0010	-0.2407
40	-0.0100	-0.0055	-1.8508
41	-0.0040	-0.0059	-3.2032
42	-0.0020	-0.0024	-2.4139
43	-0.0040	00.0010	00.2209
44	00.0004	-0.0002	-0.1021
45	00.0020	00.0028	02.7780

Table A-12B(cont'd)

Fund	jn	trm[1]	ztr[2]
46	-0.0050	-0.0027	-0.6140
47	-0.0005	00.0050	01.4219
48	-0.0010	-0.0010	-1.0176
49	00.0010	00.0028	00.8073
50	-0.0020	-0.0035	-3.5357
51	-0.0060	-0.0005	-0.4976
52	-0.0010	-0.0004	-0.3579
53	-0.0003	00.0013	00.3189
54	-0.0020	00.0022	00.5384
55	-0.0050	-0.0041	-0.9303
56	-0.0004	00.0025	00.7483
57	-0.0010	00.0045	04.4888
58	-0.0010	00.0019	00.4888
59	-0.0010	00.0001	00.0876
60	-0.0010	-0.0022	-2.2009
61	00.0010	00.0018	01.0497
62	-0.0040	-0.0016	-0.3277
63	-0.0010	-0.0014	-0.4007
64	-0.0040	-0.0068	-1.6130
65	00.0100	00.0146	02.9031
66	00.0100	00.0116	02.2465
67	00.0020	00.0001	00.0266
68	-0.0020	-0.0045	-2.2960
69	-0.0030	-0.0001	-0.0420
70	00.0050	00.0008	00.1291
71	-0.0050	00.0023	02.3192
72	-0.0040	00.0049	01.2312
73	00.0030	00.0036	01.9928
74	-0.0010	00.0039	00.8324
75	-0.0060	-0.0014	-1.4026
76	-0.0040	-0.0014	-1.4026
77	-0.0050	-0.0059	-5.8697
78	-0.0030	-0.0036	-3.6247
79	-0.0010	-0.0026	-0.7518
80	-0.0030	-0.0018	-1.7823
81	-0.0005	-0.0007	-0.3599
82	-0.0005	-0.0028	-0.7415
83	-0.0010	00.0011	01.0510
84	-0.0002	00.0016	00.9139
85	-0.0010	00.0005	00.5416
86	00.0002	00.0001	00.0216
87	-0.0040	-0.0023	-1.1283
88	00.0010	00.0021	02.0994
89	-0.0030	00.0006	00.1412
90	00.0003	00.0011	01.0609

Table A-12B(cont'd)

Fund	jn	trm[1]	ztr[2]
91	-0.0010	-0.0017	-1.6833
92	00.0003	00.0010	00.9054
93	-0.0020	-0.0031	-0.6844
94	-0.0010	-0.0008	-0.5340
95	00.0007	00.0013	01.3256
96	-0.0020	00.0020	00.5894
97	00.0040	00.0087	01.6643
98	-0.0080	00.0055	01.4334
99	-0.0030	-0.0006	-0.2320
100	00.0100	00.0045	00.6609
101	00.0001	00.0006	00.8432
102	00.0004	00.0013	01.2535
103	-0.0020	-0.0033	-3.3359

[1]transformed Treynor measure
[2]standardized Treynor measure

Table A-13. Fund managers and the funds they manage

(Managers for whom portfolios were constructed are labled with an M-series number in brackets)

1. AGF Management Ltd(M1): 2, 3, 8, 12, 14, 15, 19, 20, 32
2. Beaubran Corporation Ltd: 16
3. Calvin Bullock Ltd(M2): 1, 13
4. Canada Trustco Mortgage Corporation(M3): 78, 79, 102, 103
5. Capital Growth Fund Ltd: 17
6. Central Group(Cambridge Management Group)(M4): 4, 5, 6, 11, 39, 40, 51, 74, 99
7. CSA Management Group: 31
8. Cundhill and Associates Ltd: 7, 67, 68
9. Dixon, Krogseth Ltd: 75
10. Domequity Investments Ltd: 26
11. Eaton/Bay Group(M5): 27, 28, 96, 97, 98
12. Fiducie du Québec(M6): 21, 22, 23, 24, 80, 81
13. Fiducie Prêt et Révènue(M7): 62, 63
14. Frazer and Associates: 9
15. Guardian Capital Group(M8): 29, 30, 33, 34, 48, 49
16. Investors Group(M9): 41, 42, 43, 44, 60, 100
17. Guaranty Trust Company(M10): 82, 83, 84, 85
18. Jones-Heward Ltd: 45
19. MacKenzie Financial Corporation(M11): 36, 37, 38
20. Marlborough Fund Ltd: 47
21. MEF Management Ltd: 46
22. Montreal Trust Company(M12): 86, 87, 88, 94, 95
23. National Trust Company: 50
24. NW Investments Ltd: 52
25. Pemberton Securities Ltd(M13): 53, 54
26. People's Management Ltd: 25
27. Phillips, Hager and North Company: 56
28. PMF Group(M14): 35, 55, 77
29. Prenor Group(M15): 10, 57, 65
30. Principal Group(M16): 18, 58, 59
31. Prudential Assurance Company: 101
32. Royal Bank of Canada: 61
33. Royal Trust Company Ltd(M17): 89, 90, 91, 92
34. Sterling Trust Corporation: 64
35. Templeton Investment Counsel Ltd: 66
36. United Financial Management Ltd(M18): 69, 70, 71, 72
37. Universal Group of Funds: 73
38. VGM Trustco Ltd: 93
39. Western Investment Services Company: 76

Table A-14A. Portfolio data, 1971-1975

Fund	Mean return	Standard deviation	$\hat{b}^1$	$\hat{b}^2$	$\hat{b}^3$
Value-weighted portfolios					
1	-0.0083	0.0439	0.67	0.84	0.81
2	-0.0038	0.0422	0.71	0.66	0.71
3	-0.0046	0.0421	0.74	0.81	0.74
4	-0.0106	0.0390	0.60	0.74	0.62
5	-0.0050	0.0482	0.75	0.83	0.75
6	-0.0053	0.0326	0.51	0.56	0.51
7	-0.0046	0.0473	0.73	0.81	0.91
8	-0.0063	0.0409	0.67	0.79	0.82
9	-0.0046	0.0417	0.66	0.74	0.79
10	-0.0032	0.0302	0.54	0.62	0.59
11	00.0034	0.0397	0.46	0.67	0.68
12	-0.0022	0.0292	0.51	0.53	0.56
13	-0.0073	0.0588	0.87	0.88	0.87
14	-0.0090	0.0659	1.01	1.35	1.22
15	-0.0081	0.0566	0.91	1.11	1.15
16	-0.0090	0.0557	0.83	1.10	1.08
17	-0.0004	0.0121	0.18	0.23	0.22
18	-0.0101	0.0529	0.71	0.88	0.71
Equal-weighted portfolios					
1	-0.0056	0.0439	0.71	0.84	0.88
2	-0.0053	0.0476	0.77	0.88	0.92
3	-0.0033	0.0294	0.50	0.55	0.48
4	-0.0073	0.0301	0.47	0.60	0.58
5	-0.0052	0.0519	0.80	1.02	0.80
6	-0.0076	0.0385	0.59	0.57	0.71
7	-0.0068	0.0514	0.70	1.11	1.13
8	-0.0081	0.0434	0.66	0.81	0.85
9	-0.0045	0.0420	0.64	0.88	0.82
10	-0.0029	0.0265	0.46	0.55	0.53
11	00.0020	0.0401	0.49	0.73	0.73
12	-0.0035	0.0293	0.49	0.52	0.49
13	-0.0084	0.0615	0.87	0.88	0.87
14	-0.0091	0.0645	0.99	1.32	1.19
15	-0.0091	0.0609	0.97	1.26	1.25
16	-0.0082	0.0606	0.95	1.21	1.20
17	-0.0037	0.0270	0.45	0.49	0.45
18	-0.0157	0.0574	0.80	0.96	0.98

[1] β estimated from capital asset pricing model, including synchronous market term only

[2] β estimated from aggregated coefficients, dummy variable model

[3] β estimated from aggregated coefficients, independent regression

Table A-14B. Portfolio data, 1976-1980

Fund	Mean return	Standard deviation	$\hat{b}$[1]	$\hat{b}$[2]	$\hat{b}$[3]
Value-weighted portfolios					
1	00.0117	00.0342	0.55	0.68	0.55
2	00.0046	00.0363	0.61	0.57	0.50
3	00.0053	00.0362	0.53	0.63	0.69
4	00.0053	00.0234	0.36	0.37	0.36
5	00.0077	00.0322	0.45	0.58	0.39
6	00.0009	00.0178	0.25	0.19	0.07
7	00.0046	00.0403	0.67	0.56	0.51
8	00.0089	00.0362	0.60	0.79	0.71
9	00.0057	00.0350	0.57	0.61	0.57
10	00.0047	00.0289	0.52	0.37	0.35
11	00.0060	00.0384	0.42	0.42	0.20
12	00.0034	00.0273	0.44	0.53	0.44
13	00.0067	00.0364	0.49	0.88	0.49
14	00.0087	00.0631	0.75	1.35	0.75
15	00.0155	00.0401	0.60	1.10	0.95
16	00.0102	00.0459	0.66	1.10	0.46
17	-0.0003	00.0132	0.16	0.01	-0.09
18	00.0095	00.0485	0.74	0.88	0.53
Equal-weighted portfolios					
1	00.0122	00.0334	0.54	0.62	0.55
2	00.0084	00.0378	0.62	0.67	0.60
3	00.0027	00.0272	0.43	0.55	0.56
4	00.0038	00.0208	0.30	0.47	0.21
5	00.0088	00.0340	0.47	0.60	0.29
6	00.0046	00.0291	0.47	0.57	0.28
7	00.0043	00.0392	0.59	0.62	0.59
8	00.0103	00.0376	0.59	0.81	0.72
9	00.0056	00.0324	0.51	0.65	0.50
10	00.0026	00.0248	0.43	0.19	0.22
11	00.0062	00.0377	0.47	0.23	0.23
12	00.0030	00.0252	0.42	0.52	0.21
13	00.0067	00.0363	0.49	0.50	0.49
14	00.0081	00.0622	0.76	1.32	1.37
15	00.0146	00.0394	0.59	0.59	0.93
16	00.0107	00.0472	0.67	1.21	0.47
17	00.0025	00.0227	0.38	0.38	0.35
18	00.0114	00.0491	0.74	0.76	0.72

[1] β estimated from capital asset pricing model, including synchronous market term only

[2] β estimated from aggregated coefficients, dummy variable model

[3] β estimated from aggregated coefficients, independent regression

Table A-15. Results of dummy variable regression analyses for portfolios

Value-weighted portfolios

1. $r=0.005-0.01D+0.60m_0+0.08m_1+0.17Dm_{-1}.$
   (1.71) (-2.53) (15.96) (2.01) (3.12)

2. $r=-0.001+0.64m_0+0.09Dm_{-1}-0.07m_{-2}.$
   (-0.73) (19.93) (2.04) (-2.26)

3. $r=-0.002+0.55m_0+0.18Dm_0+0.08m_1.$
   (-0.83) (11.44) (2.91) (2.42)

4. $r=0.001-0.011D+0.37m_0+0.22Dm_0+0.15Dm_{-1}.$
   (0.61) (-2.84) (8.25) (3.46) (3.03)

5. $r=0.0001+0.48m_0+0.25Dm_0+0.10m_1+0.14Dm_{-1}.$
   (0.04) (7.86) (2.84) (2.19) (2.21)

6. $r=-0.002+0.24m_0+0.26Dm_0+0.09m_{-1}-0.14m_{-2}+0.11Dm_{-2}$
   (-1.27) (6.67) (5.00) (2.56) (-3.94) (2.16)

7. $r=-0.002+0.68m_0+0.21Dm_{-1}-0.09m_{-2}.$
   (-0.85) (16.83) (3.67) (-2.11)

8. $r=-0.001+0.64m_0+0.15m_{-1}.$
   (-0.73) (20.38) (4.60)

9. $r=-0.0001+0.61m_0+0.13Dm_{-1}-1.11Dm_0^2.$
   (-0.07) (18.16) (2.72) (-2.06)

10. $r=0.001-0.004D+0.51m_0+0.07Dm_1-0.07m_{-1}+0.11Dm_{-1}$
    $-0.07m_{-2}+0.07D_{-2}+0.71m_0^2$
    (0.88) (-2.25) (31.94) (3.18) (-3.18) (3.35) (-3.02)
    (2.34) (2.59)

11. $r=0.003+0.42m_0+0.25Dm_{-1}.$
    (1.26) (7.78) (3.14)

12. $r=-0.001+0.47m_0+0.06m_1.$
    (-1.01) (20.51) (2.47)

13. $r=-0.001+0.50m_0+0.38Dm_0.$
    (-0.33) (6.32) (3.33)

14. $r=-0.005+0.89m_0+0.26m_{-1}+0.20m_1.$
    (-1.19) (11.76) (3.35) (2.61)

15. $r=0.0003+0.68m_0+0.20Dm_0+0.20m_1-0.19Dm_1+0.22m_{-1}.$
    (0.13) (10.53) (2.16) (3.11) (-2.11) (4.76)

16. $r=-0.004+0.77m_0+0.11m_1+0.22m_{-1}.$
(-1.24) (14.51) (1.98) (4.12)

17. $r=-0.0005+0.15m_0+0.04m_1-0.06m_{-1}+0.11Dm_{-1}$
$-0.12m_{-2}+0.11Dm_{-2}+0.48Dm_0{}^2.$
(-0.71) (11.24) (2.83) (-3.39) (4.17) (-6.51) (4.06)
(2.23)

18. $r=-0.003+0.75m_0+0.13m_{-1}.$
(-1.05) (12.82) (2.14)

Equal-weighted portfolios

1. $r=0.006-0.009D+0.60m_0+0.10m_1+0.22Dm_{-1}-0.08m_{-2}$
(2.42) (-2.52) (17.72) (3.05) (4.68) (-2.39)

2. $r=-0.0002+0.68m_0+0.09m_1+0.21Dm_{-1}-0.10m_{-2}.$
(-0.13) (18.48) (2.37) (3.93) (-2.64)

3. $r=-0.002+0.47m_0+0.08m_1.$
(-1.89) (20.07) (3.39)

4. $r=-0.003+0.13Dm_0+0.34m_0+0.12Dm_{-1}.$
(-1.86) (2.08) (7.86) (2.76)

5. $r=-0.002+0.32m_0+0.13Dm_0+0.05m_1+0.01m_{-1}-0.55m_0{}^2.$
(-1.16) (8.63) (2.52) (2.01) (4.09) (-2.05)

6. $r=-0.003+0.53m_0+0.11m_{-1}-0.07m_{-2}.$
(-2.14) (16.59) (3.50) (-2.14)

7. $r=-0.003+0.62m_0+0.18Dm_1+0.31Dm_{-1}.$
(-1.08) (12.54) (2.60) (4.23)

8. $r=-0.001+0.63m_0+0.17m_{-1}.$
(-0.68) (15.96) (4.36)

9. $r=-0.001+0.57m_0+0.08m_1+0.23Dm_{-1}.$
(-0.79) (15.76) (2.30) (4.40)

10. $r=0.001-0.004D+0.38m_0+0.06Dm_0+0.07Dm_1+0.14Dm_{-1}-0.10m_{-1}$
$+0.08Dm_{-2}-0.09m_{-2}+0.80Dm_0{}^2.$
(0.98) (-2.43) (16.95) (2.09)(3.26) (4.41) (-4.29)
(2.54) (-3.81) (2.86)

11. $r=0.004+0.45m_0+0.25Dm_{-1}+0.21Dm_{-2}-0.20m_{-2}.$
(-1.52) (9.04) (3.82) (2.10) (-2.90)

12. $r=-0.002+0.46m_0+0.06m_1.$
(-1.76) (21.31) (2.82)

13. $r=-0.001+0.50m_0+0.38Dm_0.$
(-0.46) (5.90) (3.09)

14. $r=-0.005+0.88m_0+0.19m_1+0.26m_{-1}$.
(-1.30) (12.08) (2.62) (3.46)

15. $r=0.008-0.014D+0.58m_0+0.35Dm_0+0.32Dm_{-1}$.
(2.48) (-2.70) (8.85) (3.66) (4.68)

16. $r=-0.003+0.83m_0+0.14m_1+0.24m_{-1}$.
(-1.12) (15.29) (4.36) (2.58)

17. $r=-0.002+0.41m_0+0.05m_1-0.08m_{-1}+0.10m_{-1}$.
(-1.54) (20.26) (2.48) (-2.79) (2.62)

18. $r=0.003-0.016D+0.76m_0+0.19Dm_{-1}$.
(0.73) (-2.43) (12.40) (2.25)

Table A-16A. Results of regression analyses for portfolios, independent regressions, 1971-1975

Value-weighted portfolios

1. $r=-0.005+0.66m_0+0.15m_{-1}.$
   (-1.64) (10.40) (2.43)

2. $r=-0.001+0.71m_0.$
   (-0.48) (14.88)

3. $r=-0.002+0.74m_0.$
   (-0.95) (19.88)

4. $r=-0.010+0.69m_0+0.15m_{-1}.$
   (-2.83) (10.77) (2.77)

5. $r=-0.002+0.75m_0.$
   (-0.61) (10.64)

6. $r=-0.003+0.49m_0+0.09m_{-1}.$
   (-1.34) (10.91) (1.93)

7. $r=-0.002+0.71m_0+0.20m_{-1}.$
   (-0.44) (10.81) (2.99)

8. $r=-0.003+0.65m_0+0.17m_{-1}.$
   (-1.40) (13.80) (3.63)

9. $r=-0.001+0.64m_0+0.13m_{-1}-1.27m_0^2.$
   (0.48) (11.90) (2.42) (-1.95)

10. $r=-0.002+0.65m_0+0.14m_1.$
    (-2.66) (11.74) (2.45)

11. $r=0.006+0.43m_0+0.25m_{-1}.$
    (1.44) (5.76) (3.30)

12. $r=-0.0003+0.50m_0+0.06m_1.$
    (-0.22) (18.60) (2.34)

13. $r=-0.004+0.87m_0.$
    (-0.84) (9.22)

14. $r=-0.005+0.99m_0+0.23m_{-1}.$
    (-0.96) (10.49) (2.47)

15. $r=-0.004+0.87m_0+0.28m_{-1}.$
    (-1.17) (12.96) (4.16)

16. $r=-0.005+0.80m_0+0.28m_{-1}.$
(-1.26) (9.93) (3.52)

17. $r=-0.001+0.18m_0+0.04m_{-1}+0.59m_0^2.$
(-1.19) (10.13) (2.05) (2.74)

18. $r=-0.008+0.71m_0.$
(-1.49) (7.40)

Equal-weighted portfolios

1. $r=-0.003+0.69m_0+0.19m_{-1}.$
(-0.93) (12.95) (3.53)

2. $r=-0.002+0.75m_0+0.17m_{-1}.$
(-0.70) (12.92) (2.90)

3. $r=-0.001+0.48m_0.$
(-0.71) (14.65)

4. $r=-0.005+0.46m_0+0.13m_{-1}.$
(-2.53) (11.50) (3.38)

5. $r=-0.002+0.80m_0.$
(-0.56) (10.63)

6. $r=-0.005+0.58m_0+0.13m_{-1}.$
(-1.77) (10.39) (2.28)

7. $r=-0.003+0.65m_0+0.18m_1+0.30m_{-1}.$
(-0.76) (7.83) (2.23) (3.64)

8. $r=-0.005+0.63m_0+0.22m_{-1}.$
(-1.65) (10.46) (3.65)

9. $r=-0.002+0.61m_0+0.21m_{-1}.$
(-0.54) (10.39) (3.58)

10. $r=-0.002+0.46m_0+06m_1+0.77m_0^2.$
(-2.84) (18.68) (2.73)(2.60)

11. $r=0.004+0.46m_0+0.27m_{-1}.$
(1.19) (6.54) (3.84)

12. $r=-0.002+0.49m_0.$
(-0.99) (14.99)

13. $r=-0.005+0.87m_0.$
(-0.95) (8.29)

14. $r=-0.005+0.96m_0+0.23m_1.$
(-1.02) (10.46) (2.51)

15. $r=-0.005+0.93m_0+0.32m_{-1}$.
$(-1.29)\ (12.97)\ (4.43)$

16. $r=-0.004+0.91m_0+0.29m_{-1}$.
$(-0.99)\ (11.50)\ (3.60)$

17. $r=-0.002+0.45m_0$.
$(-1.27)\ (14.59)$

18. $r=-0.012+0.78m_0+0.20m_{-1}$.
$(-2.41)\ (8.00)\ (2.10)$

Table A-16B. Results of regression analyses for portfolios, independent regressions, 1976-1980

Value-weighted portfolios

1. $r=0.005+0.56m_0+0.09m_1$.
(2.17) (12.52) (2.00)

2. $r=-0.0004+0.59m_0-0.09m_{-2}$.
(-0.17) (13.96) (-2.13)

3. $r=-0.001+0.55m_0+0.14m_1$.
(-0.50) (9.80) (2.54)

4. $r=0.001+0.33m_0-0.66m_0^2$.
(0.90) (8.97) (-2.03)

5. $r=0.005+0.42m_0-0.13m_{-2}$.
(1.67) (7.93) (-2.45)

6. $r=0.0003+0.22m_0-0.15m_{-2}$.
(0.24) (9.15) (-6.20)

7. $r=-0.0001+0.65m_0-0.13m_{-2}$.
(-0.21) (13.53) (-2.69)

8. $r=0.002+0.62m_0+0.11m_{-1}$.
(0.65) (14.36) (2.42)

9. $r=0.0005+0.57m_0$.
(0.20) (11.04)

10. $r=0.001+0.50m_0-0.07m_{-1}-0.07m_{-2}$.
(1.03) (23.60) (-3.53) (-3.24)

11. $r=0.004+0.39m_0-0.19m_{-2}$.
(0.99) (5.06) (-2.50)

12. $r=-0.001+0.44m_0$.
(-0.49) (11.93)

13. $r=0.002+0.49m_0$.
(0.33) (7.70)

14. $r=-0.004+0.83m_0+0.25m_{-1}+0.27m_1$.
(-0.71) (6.75) (1.97) (2.16)

15. $r=0.006+0.65m_0+0.17m_1+0.13m_{-1}$.
(1.84) (10.59) (2.67) (2.17)

16. $r=0.006+0.63m_0-0.17m_{-2}.$
(1.40) (8.64) (-2.22)

17. $r=0.0007+0.12m_0-0.08m_{-1}-0.13m_{-2}.$
(0.65) (6.15) (-4.07) (-6.39)

18. $r=0.004+0.71m_0-0.18m_{-2}.$
(1.14) (10.28) (-2.61)

Equal-weighted portfolios

1. $r=0.007+0.54m_0+0.11m_1-0.10m_{-2}.$
(3.11) (13.30) (2.61) (-2.50)

2. $r=0.002+0.62m_0+0.11m_1-0.13m_{-2}.$
(1.13) (14.40) (2.58) (-3.09)

3. $r=-0.003+0.44m_0+0.11m_1.$
(-1.47) (12.64) (3.07)

4. $r=0.002+0.29m_0-0.07m_{-2}.$
(0.96) (7.81) (-2.13)

5. $r=0.006+0.44m_0-0.15m_{-2}.$
(1.90) (7.73) (-2.51)

6. $r=0.002+0.44m_0-0.16m_{-2}.$
(1.03) (13.38) (-4.73)

7. $r=-0.002+0.59m_0.$
(-0.51) (9.88)

8. $r=0.003+0.61m_0+0.11m_{-1}.$
(0.68) (11.60) (2.02)

9. $r=0.0008+0.50m_0.$
(0.30) (10.30)

10. $r=0.0006+0.40m_0-0.10m_{-1}-0.08m_{-2}.$
(0.46) (17.61) (-4.50) (-3.47)

11. $r=-0.003+0.66m_0+0.25m_{-1}.$
(-0.77) (8.56) (3.02)

12. $r=0.0008+0.39_0-0.10m_{-1}-0.08m_{-2}.$
(0.54) (14.21) (-3.42) (-2.73)

13. $r=0.002+0.49m_0.$
(0.52) (7.69)

14. $r=-0.005+0.85m_0+0.27m_1+0.25m_{-1}.$
(-0.85) (7.17) (2.25) (2.11)

15. $r=0.005+0.64m_0+0.16m_1+0.13m_{-1}.$
$(1.65)\ (10.68)\ (2.62)\ (2.21)$

16. $r=0.006+0.64m_0-0.17m_{-2}.$
$(1.44)\ (8.33)\ (-2.17)$

17. $r=-0.00006+0.36m_0-0.10m_{-1}.$
$(-0.45)\ (13.92)\ (-3.80)$

18. $r=0.004+0.73m_0+0.15m_1-0.16m_{-2}.$
$(1.08)\ (9.93)\ (2.09)\ (-2.13)$

Table A-17A. Regression statistics from dummy regression regressions for portfolios

Fund	R^2	DW value*	Q-value
Value-weighted portfolios			
1	0.73	2.03	02.02
2	0.80	2.49	11.78
3	0.76	3.03	37.39
4	0.72	2.28	04.84
5	0.67	2.05	07.28
6	0.72	2.15	10.60
7	0.75	2.54	17.16
8	0.80	2.13	09.46
9	0.77	2.52	10.55
10	0.92	1.52	14.40
11	0.42	2.05	07.87
12	0.79	2.39	10.04
13	0.59	2.03	06.51
14	0.58	2.23	05.61
15	0.75	1.70	07.72
16	0.68	2.10	01.95
17	0.69	1.87	04.99
18	0.60	2.75	24.46
Equal-weighted portfolios			
1	0.80	2.11	02.38
2	0.79	2.12	05.53
3	0.63	2.80	24.25
4	0.63	2.30	00.92
5	0.66	1.99	08.97
6	0.74	1.81	03.82
7	0.64	2.44	11.22
8	0.71	2.03	04.82
9	0.71	2.17	02.79
10	0.89	1.65	10.82
11	0.53	1.94	10.47
12	0.81	1.66	03.61
13	0.55	1.96	02.59
14	0.60	2.24	05.54
15	0.75	1.84	05.83
16	0.70	2.00	05.24
17	0.80	1.90	06.53
18	0.63	2.38	12.48

*Durbin-Watson statistic

Table A-17B. Regression statistics from independent regressions, 1971-1975, for portfolios

Fund	R^2	DW value*	Q-value
Value-weighted portfolios			
1	0.70	1.95	02.87
2	0.81	2.64	08.11
3	0.88	2.76	11.26
4	0.72	2.53	05.00
5	0.69	2.16	06.70
6	0.70	2.24	08.34
7	0.73	2.66	15.78
8	0.81	2.24	12.30
9	0.75	2.70	11.45
10	0.92	1.53	12.04
11	0.49	1.68	06.88
12	0.88	2.23	11.22
13	0.62	2.12	05.60
14	0.71	2.53	08.60
15	0.80	1.79	02.87
16	0.70	2.11	02.68
17	0.70	1.93	03.69
18	0.51	2.85	05.32
Equal-weighted portfolios			
1	0.79	2.29	01.88
2	0.79	2.47	07.12
3	0.81	2.58	10.96
4	0.75	2.50	05.76
5	0.68	2.13	07.67
6	0.70	1.97	03.99
7	0.64	2.35	07.20
8	0.72	2.12	08.90
9	0.72	2.13	03.25
10	0.88	1.81	09.24
11	0.56	1.73	09.52
12	0.81	1.76	04.29
13	0.57	2.02	02.68
14	0.71	2.57	09.20
15	0.80	1.72	03.26
16	0.75	2.10	01.59
17	0.80	1.78	03.97
18	0.59	2.06	04.65

*Durbin-Watson statistic

Table A-17C. Regression statistics from independent regressions, 1976-1980, for portfolios

Fund	R^2	DW value*	Q-value
Value-weighted portfolios			
1	0.71	2.08	01.49
2	0.79	2.54	12.21
3	0.63	3.27	29.18
4	0.68	1.71	05.51
5	0.58	1.94	02.78
6	0.72	2.02	10.86
7	0.79	2.20	03.09
8	0.78	2.14	01.36
9	0.74	2.09	03.28
10	0.92	1.42	12.34
11	0.40	2.24	05.10
12	0.71	2.48	08.18
13	0.51	1.91	05.27
14	0.39	2.15	06.29
15	0.67	1.57	05.26
16	0.61	2.17	03.71
17	0.68	1.79	00.88
18	0.69	2.44	08.67
Equal-weighted portfolios			
1	0.78	1.84	02.18
2	0.81	2.03	03.53
3	0.74	2.82	20.52
4	0.60	1.28	14.83
5	0.57	1.77	04.17
6	0.80	1.57	09.26
7	0.63	2.29	06.21
8	0.70	2.09	03.50
9	0.69	2.08	04.70
10	0.88	1.30	08.93
11	0.50	2.12	05.22
12	0.83	1.96	05.42
13	0.51	1.88	04.43
14	0.48	2.11	04.17
15	0.67	1.55	05.94
16	0.59	2.09	03.97
17	0.80	2.04	02.49
18	0.67	2.63	11.25

*Durbin-Watson statistic

Table A-18. Estimated autocorrelations for portfolio series, for 1971-1980

Fund	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	SE
Value-weighted portfolios							
1	00.189	-0.086	00.116	00.120	00.060	-0.078	0.090
2	00.019	-0.297	00.159	00.097	00.031	-0.032	0.090
3	-0.086	-0.076	00.077	00.066	00.076	00.066	0.090
4	00.177	-0.116	00.143	00.073	00.046	00.023	0.090
5	00.186	-0.080	00.061	00.014	00.056	-0.120	0.090
6	00.127	-0.191	00.141	00.047	-0.046	00.048	0.090
7	00.090	-0.296	00.013	00.036	00.082	00.001	0.090
8	00.141	-0.206	00.045	-0.023	00.113	00.057	0.090
9	00.093	-0.221	00.011	00.045	00.173	-0.022	0.090
10	00.046	-0.146	00.087	-0.015	00.093	-0.006	0.090
11	00.065	-0.060	-0.002	-0.106	-0.099	-0.118	0.090
12	00.005	-0.149	00.072	00.105	-0.061	00.044	0.090
13	00.133	-0.183	00.003	00.091	-0.084	-0.064	0.090
14	00.139	-0.213	-0.044	00.023	00.028	00.051	0.090
15	00.272	-0.099	00.058	00.020	-0.045	-0.112	0.090
16	00.181	-0.183	-0.014	00.075	-0.008	-0.060	0.090
17	00.152	-0.124	00.004	-0.003	00.092	00.047	0.090
18	-0.042	-0.038	00.009	00.086	00.182	00.008	0.090
Equal-weighted portfolios							
1	00.217	-0.143	00.105	00.096	00.026	-0.032	0.090
2	00.112	-0.286	00.119	00.135	00.022	-0.015	0.090
3	-0.038	-0.120	-0.023	-0.016	00.123	00.041	0.090
4	00.242	-0.172	00.046	00.093	00.055	00.062	0.090
5	00.194	-0.058	00.076	-0.008	00.066	-0.129	0.090
6	00.176	-0.162	00.088	-0.012	00.042	00.009	0.090
7	00.134	-0.202	00.007	00.088	00.099	-0.084	0.090
8	00.188	-0.163	00.026	-0.001	00.117	00.046	0.090
9	00.180	-0.157	00.050	00.067	00.121	-0.076	0.090
10	00.059	-0.117	00.073	-0.009	00.084	-0.015	0.090
11	00.119	-0.117	-0.021	-0.109	-0.044	-0.124	0.090
12	00.054	-0.137	00.127	00.035	00.011	-0.014	0.090
13	00.142	-0.188	00.017	00.077	-0.061	-0.089	0.090
14	00.139	-0.216	-0.047	00.025	00.026	00.049	0.090
15	00.294	-0.111	00.057	00.025	-0.071	-0.103	0.090
16	00.213	-0.213	-0.044	00.097	-0.012	-0.036	0.090
17	00.046	-0.089	00.115	00.014	00.072	-0.057	0.090
18	00.126	-0.037	00.034	00.026	00.181	00.007	0.090

Table A-19A. Estimated autocorrelations for residuals from dummy variable regressions for portfolios

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
Value-weighted portfolios							
1	-0.037	-0.055	-0.038	00.072	00.075	00.016	0.090
2	-0.261	-0.122	00.089	-0.032	00.078	-0.053	0.090
3	-0.544	00.125	-0.157	-0.035	00.067	-0.059	0.090
4	-0.142	00.095	00.085	-0.021	00.066	00.012	0.090
5	-0.030	00.076	00.197	-0.025	00.119	-0.035	0.090
6	-0.079	-0.038	00.198	-0.190	-0.002	00.080	0.090
7	-0.272	-0.175	00.198	00.036	-0.039	-0.023	0.090
8	-0.066	-0.148	00.172	-0.085	00.109	00.070	0.090
9	-0.280	-0.038	-0.026	-0.007	00.091	-0.038	0.090
10	00.230	00.166	00.079	00.118	-0.142	00.044	0.090
11	-0.032	00.026	-0.001	-0.072	-0.194	-0.145	0.090
12	00.205	-0.069	-0.010	-0.013	-0.150	00.125	0.090
13	-0.021	00.031	-0.159	00.119	-0.114	00.035	0.090
14	-0.118	-0.121	-0.065	00.066	-0.083	-0.061	0.090
15	00.150	00.048	-0.023	00.181	00.079	-0.028	0.090
16	-0.053	00.025	-0.055	00.099	00.011	00.005	0.090
17	00.064	00.150	00.067	00.069	-0.044	00.067	0.090
18	-0.378	00.122	-0.127	00.169	00.027	00.079	0.090
Equal-weighted portfolios							
1	-0.076	-0.021	00.113	00.007	00.018	00.027	0.090
2	-0.078	-0.145	00.064	00.112	-0.002	00.057	0.090
3	-0.403	00.094	-0.140	00.103	00.009	00.080	0.090
4	00.027	00.030	00.009	00.053	00.043	00.036	0.090
4	00.003	00.095	00.207	-0.027	00.133	-0.071	0.090
6	00.088	00.031	00.132	-0.040	-0.008	-0.009	0.090
7	-0.224	-0.062	00.005	00.086	00.106	-0.149	0.090
8	-0.016	-0.027	00.139	00.008	00.089	00.109	0.090
9	-0.088	00.019	-0.040	00.004	00.072	-0.054	0.090
10	00.168	00.169	-0.025	00.031	-0.175	00.054	0.090
11	00.028	00.027	-0.012	-0.117	-0.157	-0.216	0.090
12	00.146	00.019	-0.015	-0.065	00.015	00.067	0.090
13	00.014	-0.009	-0.117	00.063	-0.059	00.018	0.090
14	-0.124	-0.099	-0.064	00.050	-0.106	-0.064	0.090
15	00.077	00.020	-0.075	00.174	00.002	-0.082	0.090
16	-0.007	-0.002	-0.071	00.198	00.010	00.020	0.090
17	00.025	00.150	00.127	00.022	00.125	-0.008	0.090
18	-0.194	00.166	-0.113	00.096	00.078	00.112	0.090

Table A-19B. Estimated autocorrelations for residuals from independent regressions, 1971-1975, for portfolios

Fund	p_1	p_2	p_3	p_4	p_5	p_6	SE
Value-weighted portfolios							
1	00.074	-0.003	-0.125	00.050	00.132	00.081	0.123
2	-0.337	-0.016	-0.067	00.071	-0.022	-0.126	0.123
3	-0.435	00.011	00.028	00.049	-0.009	00.063	0.123
4	-0.270	00.021	00.015	-0.087	00.053	00.052	0.123
5	-0.093	00.010	00.204	-0.246	00.003	00.031	0.123
6	-0.083	00.063	00.138	-0.308	00.078	-0.086	0.123
7	-0.325	-0.250	00.298	-0.090	00.004	-0.076	0.123
8	-0.108	-0.255	00.268	-0.175	00.046	00.159	0.123
9	-0.368	-0.042	00.061	-0.091	00.194	-0.108	0.123
10	00.095	00.138	-0.021	00.086	-0.099	00.257	0.123
11	00.152	00.162	-0.076	-0.155	-0.367	-0.162	0.123
12	-0.107	-0.029	00.132	-0.295	-0.087	00.244	0.123
13	-0.073	00.039	-0.268	00.029	-0.102	00.064	0.123
14	-0.302	00.030	00.044	00.217	-0.011	-0.077	0.123
15	00.121	00.078	-0.134	-0.015	-0.092	-0.034	0.123
16	-0.057	00.121	-0.101	-0.055	-0.033	-0.112	0.123
17	00.028	00.219	00.014	00.014	-0.096	00.062	0.123
18	-0.427	00.240	-0.122	00.072	00.068	00.044	0.123
Equal-weighted portfolios							
1	-0.137	-0.041	00.032	-0.018	00.088	-0.044	0.123
2	-0.245	-0.063	00.055	00.213	-0.091	-0.009	0.123
3	-0.402	00.021	-0.097	00.080	-0.029	00.106	0.123
4	-0.251	-0.086	00.027	-0.152	00.047	00.047	0.123
5	-0.089	00.087	00.213	-0.252	00.034	-0.053	0.123
6	00.029	-0.071	00.142	-0.182	00.082	00.016	0.123
7	-0.194	-0.145	00.138	-0.086	00.112	-0.153	0.123
8	-0.021	-0.171	00.280	-0.092	00.123	00.132	0.123
9	-0.080	-0.114	00.009	-0.087	00.141	-0.084	0.123
10	-0.055	00.134	-0.004	00.084	-0.172	00.303	0.123
11	00.134	00.103	-0.036	-0.135	-0.297	-0.142	0.123
12	00.109	00.132	-0.077	-0.101	-0.085	00.137	0.123
13	-0.016	-0.015	-0.195	-0.060	-0.035	00.041	0.123
14	-0.321	00.013	00.054	00.211	-0.020	-0.081	0.123
15	00.163	00.101	-0.072	00.021	-0.115	-0.007	0.123
16	-0.045	00.060	-0.085	00.011	00.011	-0.115	0.123
17	00.129	00.189	00.050	00.022	00.074	00.081	0.123
18	-0.024	00.214	-0.033	-0.040	00.162	00.054	0.123

Table A-19C. Estimated autocorrelations for residuals from independent regressions, 1976-1980, for portfolios

Fund	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	SE
Value-weighted portfolios							
1	-0.084	-0.007	-0.071	00.037	00.069	00.066	0.118
2	-0.273	-0.138	00.155	-0.154	00.215	-0.017	0.118
3	-0.645	-0.184	00.039	00.084	-0.054	-0.001	0.118
4	00.121	00.194	00.113	00.002	00.105	-0.036	0.118
5	00.019	00.022	00.166	00.051	00.099	-0.036	0.118
6	-0.066	-0.106	00.323	-0.107	-0.079	00.165	0.118
7	-0.121	-0.076	00.055	00.153	-0.010	-0.026	0.118
8	-0.072	-0.084	00.084	00.020	00.034	00.002	0.118
9	-0.104	00.116	-0.157	-0.027	00.028	00.016	0.118
10	00.266	00.141	00.185	00.048	-0.205	-0.141	0.118
11	-0.145	00.087	00.067	-0.091	-0.105	-0.157	0.118
12	-0.262	00.050	-0.122	00.119	-0.163	-0.003	0.118
13	-0.009	-0.061	-0.073	00.196	-0.176	-0.024	0.118
14	-0.077	-0.151	-0.221	-0.027	-0.129	-0.038	0.118
15	00.140	00.031	-0.104	00.182	00.122	00.026	0.118
16	-0.128	-0.038	-0.032	00.140	-0.086	00.102	0.118
17	00.091	00.063	00.001	-0.019	-0.025	00.025	0.118
18	-0.227	00.052	00.026	00.183	-0.115	00.173	0.118
Equal-weighted portfolios							
1	00.035	00.105	00.108	00.016	00.065	00.070	0.118
2	-0.018	-0.104	00.150	00.014	00.140	-0.010	0.118
3	-0.424	00.290	-0.115	00.072	-0.098	00.166	0.118
4	00.280	00.297	00.048	00.238	00.051	00.045	0.118
5	00.094	00.018	00.157	00.073	00.111	-0.106	0.118
6	00.144	00.261	00.041	00.071	-0.216	-0.004	0.118
7	-0.185	00.108	-0.180	00.131	00.032	-0.006	0.118
8	-0.053	00.131	-0.131	00.116	-0.051	00.022	0.118
9	-0.068	00.218	-0.076	00.100	00.068	-0.011	0.118
10	00.249	00.176	00.125	-0.062	-0.020	-0.158	0.118
11	-0.062	-0.047	00.062	-0.111	-0.043	-0.230	0.118
12	-0.019	00.058	00.154	-0.080	00.810	-0.200	0.118
13	-0.001	-0.092	-0.084	00.174	-0.143	-0.024	0.118
14	-0.060	-0.117	-0.128	-0.019	-0.143	-0.092	0.118
15	00.150	-0.020	-0.116	00.171	00.156	00.021	0.118
16	-0.090	-0.037	-0.099	00.155	-0.072	00.107	0.118
17	-0.058	00.035	-0.000	-0.003	00.178	00.028	0.118
18	-0.337	00.197	-0.055	00.031	-0.052	00.131	0.118

Table A-20A. Sharpe Indexes, 1971-1975, for portfolios

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
Value-weighted portfolios			
1	-0.1879	-0.1853	0.1373
2	-0.0897	-0.0885	0.1364
3	-0.1084	-0.1069	0.1365
4	-0.2723	-0.2686	0.1386
5	-0.1029	-0.1015	0.1364
6	-0.1618	-0.1595	0.1370
7	-0.0975	-0.0962	0.1364
8	-0.1537	-0.1516	0.1369
9	-0.1107	-0.1092	0.1365
10	-0.1050	-0.1035	0.1365
11	0.0861	0.0850	0.1363
12	-0.0767	-0.0757	0.1363
13	-0.1248	-0.1231	0.1366
14	-0.1360	-0.1341	0.1367
15	-0.1427	-0.1407	0.1368
16	-0.1609	-0.1587	0.1370
17	-0.0341	-0.0337	0.1361
18	-0.1915	-0.1889	0.1373
Equal-weighted portfolios			
1	-0.1276	-0.1259	0.1366
2	-0.1119	-0.1103	0.1365
3	-0.1127	-0.1111	0.1365
4	-0.2420	-0.2387	0.1381
5	-0.0993	-0.0980	0.1364
6	-0.1974	-0.1947	0.1374
7	-0.1322	-0.1304	0.1367
8	-0.1872	-0.1846	0.1373
9	-0.1059	-0.1045	0.1365
10	-0.1107	-0.1091	0.1365
11	0.0506	0.0499	0.1362
12	-0.1200	-0.1184	0.1366
13	-0.1370	-0.1352	0.1367
14	-0.1404	-0.1385	0.1368
15	-0.1498	-0.1478	0.1368
16	-0.1352	-0.1334	0.1367
17	-0.1381	-0.1363	0.1367
18	-0.2739	-0.2701	0.1386

[1]as traditionally calculated
[2]adjusted

Table A-20B. Sharpe Indexes, 1976-1980, for portfolios

Fund	Sharpe Index[1]	Sharpe Index[2]	Standard deviation
Value-weighted portfolios			
1	0.3427	0.3385	0.1328
2	0.1274	0.1258	0.1296
3	0.1471	0.1453	0.1298
4	0.2262	0.2234	0.1307
5	0.2384	0.2355	0.1309
6	0.0530	0.0523	0.1292
7	0.1144	0.1130	0.1295
8	0.2461	0.2431	0.1310
9	0.1640	0.1619	0.1300
10	0.1614	0.1594	0.1299
11	0.1551	0.1532	0.1299
12	0.1263	0.1247	0.1296
13	0.1832	0.1809	0.1302
14	0.1374	0.1357	0.1297
15	0.3862	0.3814	0.1338
16	0.2218	0.2191	0.1307
17	-0.0217	-0.0215	0.1291
18	0.1963	0.1939	0.1303
Equal-weighted portfolios			
1	0.3645	0.3600	0.1333
2	0.2231	0.2203	0.1307
3	0.0992	0.0980	0.1294
4	0.1839	0.1816	0.1302
5	0.2577	0.2546	0.1312
6	0.1598	0.1578	0.1299
7	0.1105	0.1091	0.1295
8	0.2746	0.2712	0.1315
9	0.1734	0.1713	0.1301
10	0.1064	0.1051	0.1295
11	0.1639	0.1619	0.1300
12	0.1174	0.1159	0.1295
13	0.1853	0.1830	0.1302
14	0.1310	0.1293	0.1297
15	0.3703	0.3657	0.1335
16	0.2262	0.2234	0.1307
17	0.1095	0.1082	0.1295
18	0.2316	0.2287	0.1308

[1]as traditionally calculated
[2]adjusted

Table A-21A. Transformed Sharpe statistics, 1971-1975, for portfolios

Fund	shm[1]	zsh[2]
Value-weighted portfolios		
1	-0.0003	-1.4457
2	-0.0000	-0.3586
3	-0.0001	-0.8556
4	-0.0004	-2.4552
5	-0.0001	-0.4381
6	-0.0002	-1.1886
7	-0.0001	-0.3664
8	-0.0002	-1.2377
9	-0.0001	-0.5701
10	-0.0001	-0.8336
11	0.0003	1.2860
12	-0.0000	-0.1735
14	-0.0002	-0.6396
14	-0.0002	-0.8312
15	-0.0002	-1.0083
16	-0.0003	-1.0581
17	0.0000	0.3866
18	-0.0003	-1.1946
Equal-weighted portfolios		
1	-0.0001	-0.8270
2	-0.0001	-0.6223
3	-0.0001	-0.7919
4	-0.0003	-2.1673
5	-0.0001	-0.3932
6	-0.0003	-1.5619
7	-0.0002	-0.6376
8	-0.0003	-1.3939
9	-0.0001	-0.4479
0	-0.0001	-0.7890
11	0.0003	1.0428
12	-0.0001	-0.8578
13	-0.0002	-0.7222
14	-0.0002	-0.8822
15	-0.0003	-1.0919
16	-0.0002	-0.8497
17	-0.0001	-1.1260
18	-0.0006	-2.0695

[1]transformed Sharpe Index
[2]standardized transformed Sharpe Index

Table A-21B. Transformed Sharpe statistics, 1976-1980, for portfolios

Fund	shm[1]	zsh[2]
Value-weighted portfolios		
1	0.0003	2.0299
2	-0.0001	-1.0152
3	-0.0001	-0.5076
4	0.0000	0.4255
5	0.0001	0.4832
6	-0.0001	-1.4479
7	-0.0002	-1.1736
8	0.0001	0.8165
9	-0.0001	-0.4101
10	-0.0000	-0.7322
11	-0.0001	-0.3092
12	-0.0001	-0.8964
13	-0.0000	-0.0907
14	-0.0002	-0.4856
15	0.0004	2.1929
16	0.0001	0.3283
17	-0.0001	-1.9014
18	0.0000	0.0520
Equal-weighted portfolios		
1	0.0003	2.3799
2	0.0001	0.4631
3	-0.0001	-1.2352
4	-0.0000	-0.0888
5	0.0001	0.6730
6	-0.0000	-0.4554
7	-0.0002	-0.9718
8	0.0002	0.0634
9	-0.0000	-0.2415
10	-0.0001	-1.5301
11	-0.0001	-0.2595
12	-0.0001	-1.1819
13	-0.0000	-0.0687
14	-0.0002	-0.5562
15	0.0004	2.0327
16	0.0001	0.3678
17	-0.0001	-1.2365
18	0.0001	0.4624

[1] transformed Sharpe Index
[2] standardized transformed Sharpe Index

Table A-22A. Treynor Indexes, 1971-1975, for portfolios

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
Value-weighted portfolios			
1	-0.0122	-0.0097	0.0071
2	-0.0053	-0.0057	0.0087
3	-0.0061	-0.0056	0.0071
4	-0.0176	-0.0142	0.0070
5	-0.0066	-0.0059	0.0079
6	-0.0103	-0.0093	0.0079
7	-0.0063	-0.0056	0.0079
8	-0.0094	-0.0079	0.0070
9	-0.0070	-0.0062	0.0076
10	-0.0059	-0.0051	0.0066
11	0.0074	0.0050	0.0080
12	-0.0044	-0.0042	0.0075
13	-0.0084	-0.0082	0.0091
14	-0.0088	-0.0066	0.0066
15	-0.0089	-0.0072	0.0069
16	-0.0108	-0.0081	0.0068
17	-0.0023	-0.0018	0.0071
18	-0.0143	-0.0113	0.0080
Equal-weighted portfolios			
1	-0.0079	-0.0066	0.0071
2	-0.0069	-0.0060	0.0073
3	-0.0066	-0.0060	0.0073
4	-0.0155	-0.0121	0.0067
5	-0.0064	-0.0050	0.0069
6	-0.0128	-0.0132	0.0091
7	-0.0097	-0.0060	0.0062
8	-0.0124	-0.0099	0.0072
9	-0.0070	-0.0050	0.0065
10	-0.0064	-0.0053	0.0066
11	0.0041	0.0027	0.0075
12	-0.0071	-0.0067	0.0077
13	-0.0097	-0.0094	0.0094
14	-0.0091	-0.0068	0.0066
15	-0.0094	-0.0072	0.0065
16	-0.0087	-0.0067	0.0068
17	-0.0082	-0.0076	0.0075
18	-0.0196	-0.0161	0.0079

[1]as traditionally calculated
[2]as revised, using β estimated from dummy variable analysis

Table A-22B. Treynor Indexes, 1976-1980, for portfolios

Fund	Treynor Index[1]	Treynor Index[2]	Standard deviation
Value-weighted portfolios			
1	0.0213	0.0139	0.0070
2	0.0076	0.0081	0.0082
3	0.0101	0.0084	0.0074
4	0.0146	0.0142	0.0080
5	0.0172	0.0130	0.0070
6	0.0038	0.0049	0.0121
7	0.0069	0.0082	0.0093
8	0.0148	0.0112	0.0059
9	0.0100	0.0094	0.0074
10	0.0089	0.0126	0.0101
11	0.0142	0.0137	0.0115
12	0.0079	0.0065	0.0066
13	0.0135	0.0075	0.0052
14	0.0116	0.0063	0.0059
15	0.0260	0.0139	0.0045
16	0.0154	0.0091	0.0053
17	-0.0018	-0.0280	0.1701
18	0.0128	0.0107	0.0070
Equal-weighted portfolios			
1	0.0224	0.0195	0.0068
2	0.0135	0.0125	0.0072
3	0.0063	0.0049	0.0064
4	0.0129	0.0080	0.0056
5	0.0188	0.0144	0.0071
6	0.0099	0.0081	0.0066
7	0.0073	0.0069	0.0081
8	0.0175	0.0126	0.0059
9	0.0111	0.0086	0.0064
10	0.0062	0.0138	0.0168
11	0.0133	0.0263	0.0208
12	0.0070	0.0057	0.0063
13	0.0137	0.0133	0.0092
14	0.0107	0.0060	0.0060
15	0.0248	0.0245	0.0082
16	0.0159	0.0087	0.0049
17	0.0066	0.0065	0.0077
18	0.0155	0.0148	0.0082

[1]as traditionally calculated
[2]as revised, using β estimated from dummy variable analysis

Table A-23A. Jensen Indexes and transformed Treynor statistics, 1971-1975, for portfolios

Fund	jn	trm[1]	ztr[2]
Value-weighted portfolios			
1	-0.0050	-0.0052	-5.2159
2	-0.0010	-0.0014	-0.4405
3	-0.0020	-0.0016	-1.6301
4	-0.0100	-0.0079	-7.9460
5	0.0001	-0.0020	-0.7527
6	-0.0020	-0.0032	-1.8332
7	-0.0020	-0.0017	-0.6394
8	-0.0010	-0.0034	-3.4255
9	-0.0001	-0.0019	-1.0562
10	-0.0030	-0.0009	-0.9226
11	0.0030	0.0058	2.4870
12	-0.0010	-0.0003	-0.3243
13	-0.0010	-0.0042	-0.8588
14	-0.0050	-0.0041	-4.0803
15	-0.0003	-0.0041	-4.0547
16	-0.0040	-0.0050	-4.9775
17	-0.0005	0.0004	0.4205
18	-0.0030	-0.0070	-2.0816
Equal-weighted portfolios			
1	-0.0030	-0.0026	-2.5678
2	-0.0002	-0.0021	-2.0093
3	-0.0020	-0.0013	-5.8347
4	-0.0030	-0.0051	-5.1263
5	-0.0020	-0.0015	-1.4631
6	-0.0030	-0.0055	-1.7200
7	-0.0030	-0.0028	-2.7715
8	-0.0010	-0.0052	-8.6318
9	-0.0010	-0.0013	-1.2690
10	-0.0030	-0.0009	-0.9473
11	0.0040	0.0047	3.6358
12	-0.0020	-0.0016	-1.2736
13	-0.0010	-0.0052	-0.9679
14	-0.0050	-0.0043	-4.2855
15	-0.0060	-0.0046	-4.5656
16	-0.0030	-0.0038	-3.8177
17	-0.0020	-0.0020	-2.1090
18	-0.0130	-0.0122	-3.4620

[1]transformed Treynor Index
[2]standardized transformed Treynor Index

Table A-23B. Jensen Indexes and transformed Treynor statistics, 1976-1980, for portfolios

Fund	jn	trm[1]	ztr[2]
Value-weighted portfolios			
1	0.0050	0.0055	3.2379
2	-0.0010	-0.0011	-0.4186
3	-0.0020	-0.0010	-0.5433
4	0.0010	0.0016	0.9095
5	0.0001	0.0018	1.3474
6	-0.0020	-0.0010	-0.5043
7	-0.0010	-0.0010	-0.2878
8	-0.0010	0.0009	0.9274
9	-0.0001	-0.0004	-0.2234
10	0.0010	0.0009	0.3313
11	0.0030	0.0017	0.4157
12	-0.0010	-0.0019	-1.9056
13	-0.0010	-0.0022	-2.2246
14	-0.0050	-0.0050	-4.9696
15	-0.0003	0.0044	4.3618
16	-0.0040	-0.0009	-0.9343
17	-0.0005	-0.0004	-0.2239
18	-0.0030	0.0006	0.3318
Equal-weighted portfolios			
1	0.0060	0.0059	6.1137
2	-0.0002	0.0017	0.9247
3	-0.0020	-0.0029	-2.8552
4	-0.0030	-0.0009	-0.9210
5	-0.0020	0.0027	1.6176
6	-0.0030	-0.0011	-1.1076
7	-0.0030	-0.0019	-0.6742
8	-0.0010	0.0021	2.1431
9	-0.0010	-0.0010	-0.9510
10	0.0010	0.0007	0.2411
11	0.0040	0.0039	0.8218
12	-0.0020	-0.0023	-2.2894
13	-0.0010	0.0017	0.5105
14	-0.0050	-0.0052	-5.1863
15	0.0080	0.0086	2.7037
16	-0.0030	-0.0015	-1.5440
17	-0.0020	-0.0013	-0.9483
18	0.0030	0.0037	0.9847

[1]transformed Treynor Index
[2]standardized transformed Treynor Index